

# FIG.2A

| Plant Name Address City State Zip Phone Fax Contact User Size Industry # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price  |  |
|---|--|
| General Informatio n  Phone Fax Contact User Size Industry  # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps packed Average seal list price   |  |
| General Information n  Phone Fax Contact User Size Industry # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price   |  |
| Information n  Phone Fax Contact User Size Industry # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price   |  |
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| Fax Contact User Size Industry # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price  |  |
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| User Size Industry # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price  |  |
| Industry # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price  | •                                      |
| # of pumps/mixers # of seals per pump # of sealed stuffing boxes in Plant % of pumps sealed % of pumps packed Average seal list price   | -                                      |
| # of seals per pump  # of sealed stuffing boxes in Plant  % of pumps sealed  % of pumps packed  Average seal list price   |  |
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| % of pumps sealed % of pumps packed Average seal list price   |  |
| % of pumps packed Average seal list price   |  |
| Average seal list price   |  |
|   | ····                                   |
| % of seals purchased new annually   |  |
| Plant % of seals purchased as factory repair or rebuild kits annually   |  |
| Profile Factory repair/rebuild price as a % of new seal price   |  |
| % of population requiring solid shaft seals   |  |
|   |  |
| Avg. shaft seal size (in inches) in plant   | ······································ |
| # of Pumps, Mixers, Flushed With Seal Water into packed boxes   |  |
| # of Pumps, Mixers, Stuffing Boxes which are flushed with seal water  |  |
| which require evaporation later on. (Ex. Dilute black liquor pumps in   |  |
| pulp & paper industry.  |  |
|   |  |
| Proposed Estimated Annual Seal Expenditure. (Revised Plant  |  |
| Estimate New Seals Only)  | <del></del>                            |
| Average Seal List Price Per Seal  |  |
| Average Cost of 1 hour of Labor With All Benefits Included  |  |
| Average Cost of Shaft or Sleeve Damage  |  |
| Avg. Cost for Bearings, Lip Seals, Gaskets, Etc.  |  |
| Additional Cost of Seasoned Trained Professional vs. Novice Per Hour  |  |
| Cost Per Seal Per Year For Housecleaning (Please Estimate)  |  |
| Annual Cost Of Production Dowtime   |  |
| Actual/Estimated Plant Cost for One Failure   |  |
| Cost of Electricity Per Kilowatt Hours  |  |
| Informatio Average Cost Of Packing Set  |  |
| Cost of Seal Flush Water Per 1,000 Gallons  |  |
| Evaporation Cost of 1 Gallon of Water   |  |
| Cost of 1 million BTUs  |  |
| Ex. If Plant Seal Water Costs Are .15/1000 gallons and effluent   |  |
|   |  |
| treatment costs are .75/1000 gallons .75/.15 = 5  |  |
| treatment costs are .75/1000 gallons .75/.15 = 5  Avg. Cost of Product/Gal. (Please keep in mind that fluids like condensate have a cost and should be included)  |  |

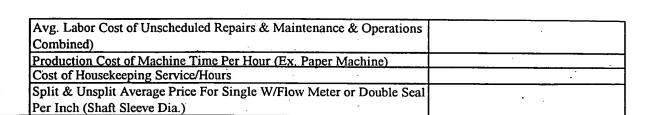


FIG. 2B

|      |                          |                        | 1     |         | 100     |       | IN THE ROLL OF THE PROPERTY OF | 1      | 1      |          | 1        |          | 1         | 1        |                 | Se II      | DEC.     | Average Decrease in Seat Ole For The Entire Plant Sell Po | 4            |                  | 4            | Plant beat ropulation  | चारुता र       |
|------|--------------------------|------------------------|-------|---------|---------|-------|--|--------|--------|----------|----------|----------|-----------|----------|-----------------|------------|----------|---|--------------|------------------|--------------|--|----------------|
|      |                          |                        |       |         |         |       |  |        |        |          |          |          |           |          | F . :           | 13T        |          |   | _            | 0                |              |  | Seals          |
| 1    |                          |                        |       |         |         | -     |  | 1 4 1  |        |          |          |          |           |          | 10.0            |            |          |   | 9            | 1 0              | <u> </u>     | <ul> <li>The interpretation of the property of the propert</li></ul> | State          |
| ĺ    |                          |                        |       | 1 t y   |         |       |  |        |        |          |          |          |           | +        | <br>            |            |          |   |              | -                | +-           |  |                |
| 1    |                          |                        |       | -       |         |       |  |        |        | -        |          |          |           |          |                 |            |          |   |              | -                | -            |  |                |
| 1    |                          |                        |       |         |         |       |  |        | +      |          | -        |          | 3.        | -        |                 |            | Ŀ        |   | $\downarrow$ |                  |              |  |                |
| ı    |                          |                        | _     | +       | -       |       | I  |        | +      |          | 1        | I        | T         | +        | +               |            |          | +   | }            | -                | †            |  |                |
| - 1  |                          | $\prod$                |       | -       |         |       |  |        |        | -        | _        |          |           |          |                 | . :        |          |   |              | 0                |              |  |                |
|      |                          |                        |       | ثند     |         |       |  | :      |        |          |          |          | • •       |          |                 |            |          |   |              | 0                |              |  | Dble           |
|      |                          |                        | :     |         |         |       |  |        |        |          | -        |          |           | H        | -               |            |          |   |              | 0                | <u> </u>     |  | 2 2 Sec        |
| ı    |                          |                        |       | H       |         |       |  | Ī.     |        | -        |          |          |           |          | -               |            |          |   |              | 8                | <del> </del> |  | Seals          |
| 1    |                          |                        |       | -       |         |       |  |        |        |          | .        |          |           |          | _               |            |          | $\vdash$  |              |                  |              |  | ्रवात <b>व</b> |
| I    |                          |                        |       | -       |         |       |  |        |        | _        | _        |          | -         | H        |                 | _          | -        |   |              | -                | $\vdash$     |  |                |
| 1 .  |                          |                        |       | -       |         |       |  |        |        |          | _        |          |           |          | _               | -          |          |   | _            |                  | -            |  |                |
| 1    |                          |                        |       |         |         |       |  |        |        |          | <u> </u> |          |           | -        | _               |            |          |   | ļ            |                  |              |  | Seals -        |
|      |                          |                        |       | -       |         |       |  |        |        |          |          |          |           |          | _               |            |          |   |              | 0                | ,            |  | Cart           |
| 1 1  |                          | ,                      |       |         |         |       |  |        |        |          |          |          |           |          | _               |            |          |   | -            | 0                |              |  |                |
|      |                          |                        |       | H       |         |       |  |        |        | -        | _        |          |           |          | -               | _          |          | 1.  |              | ٥                |              |  | -              |
|      |                          |                        |       |         |         | 1     |  |        |        |          |          |          | <br>      | 2        |                 |            |          | 2° :  |              | 0                |              |  |                |
|      |                          |                        |       |         | 7 .     |       |  | ,d     |        |          |          |          |           | `        | _               |            |          | _   | _            | -                | -::          |  |                |
|      |                          |                        |       |         |         |       |  | 12     |        |          |          |          |           |          |                 |            |          |   |              | 0                |              |  | Split          |
|      |                          |                        | <br>  |         |         | 3 6   |  |        |        |          |          |          |           |          |                 |            |          |   |              | 0                |              |  |                |
|      |                          |                        |       |         |         |       |  |        |        | FTN      | <u> </u> |          |           | -        | L               | L          |          |   |              | 0                | 7            |  |                |
|      |                          |                        |       | 4       |         |       |  |        |        |          |          |          |           | <u> </u> |                 |            |          |   |              | 0                |              |  | 1              |
|      |                          |                        | ÷     |         |         |       |  |        |        |          |          |          |           | $\vdash$ |                 |            |          |   |              | 0                |              |  | als            |
|      |                          |                        |       |         |         |       |  | 1817   |        |          | . : :    |          | - 1.<br>1 |          |                 |            |          | 14 A<br>- 12 A  |              | 0                | : :          |  | e le           |
|      |                          |                        |       |         |         |       |  | Ī.,    |        |          | _        |          |           | H        |                 |            |          | 14 gg   |              | .   0            |              |  | <u>}</u>       |
|      |                          |                        |       |         |         |       |  |        |        |          |          |          |           | _        |                 |            |          | 19 ;  | H            | 1 0              |              |  | w.::           |
|      |                          |                        |       |         |         |       |  |        |        | -8       | -        |          |           | H        | 3               |            |          |   |              | 0                |              | And the second of the second o       | i              |
|      |                          |                        |       |         |         |       |  |        |        | - 1      |          |          |           | . 1      |                 | 1.5        |          | 1 1 1   |              | 0                |              |  | 1              |
|      | :: t<br>:: t             |                        | . [:  |         |         |       |  |        |        |          | ,        |          |           |          |                 |            |          | - ;<br>- ;  | _            | _                |              | 1977年,1977年,1977年,1977年,1987年,1987年,1987年,1987年,1987年,1987年,1987年,1987年,1987年,1987年,1987年,1987年,1987年  | 7 66           |
|      | 1,6<br>1,6<br>1,6<br>1,6 | 25                     |       | t His   | 3000 C  |       |  |        | 100    | 25       | 2        | 200      | 4.9       | SO<br>SO |                 | 2.1<br>2.1 | 25       |   | 2            |                  | ٥            | 15: 91: 988 × 30   | •              |
|      |                          |                        |       | 78.6    |         |       |  |        |        | -<br>- : |          |          |           |          | H               |            |          |   | H            |                  |              | 1000 V 33.12   |                |
|      | %                        | %                      | %     |         |         |       |  | %      | %      | %        |          | %        |           | %        | _               | -          |          | : 35<br>: 35  |              | <u>ان</u><br>ابن |              |  | -              |
| •    | Est                      | Kat                    | Egt   | Est Est | Est E   | Est H | Est.   | Est    | Est.   | Est Est  | Est E    | Est. I   | E         | E        | Est. Est        |            | Est.     | _   |              |                  | 11011        |  |                |
| - سر | 0                        |                        | O     |         | LONG    | 9     | 200  | Ding N | Diago. |          | 4        | Tage I   | P         |          |                 | 6          | 7        | 6   | -<br>-       |                  | Popul        |  |                |
| 9    | R&B i                    | From P&B in Scal Rains | Plush |         | nder    |       | inmersed in Immersed in Under Flu  | 764    | mae    | S Paris  | 9 :      | Cearaice | erial     | Mai      | Design Material | )          | d Deriga | Design  |              | Scals            | SG.          |  |                |
| 3    | 1                        | (E.:                   |       | 2       | Votal 3 |       |  | 1      |        |          | 1        |          |           | 1        |                 | -          | **-      |   |              | -                | 1            |  |                |

This checklist enables front line workers to identify existing conditions in the ield which drive all decisions regarding repair/rebuild and purchase of parts, etc. The equipment checklists act as the real world indicator to arrive at scientific precise life expectancy which up until now was only obtained in labratory conditions.

This section when completed in the field automatically feeds information back to equipment mfgs holding them responsible for life of the product and all costs associated with it. This may becom obsolete over time due to the fact that mfgs will not be able to supl these specificatins in the future as customers will demand real work solutions.

identifier

|  |            |                | •   | Knov  | vledge Bas  | ed Pictoria                                      | al/Check   | dist   | Pump Mfg.<br>Specifications                      | Seal Mfg.<br>Specifications   |  |                                       |
|--|------------|----------------|---|---|-------------|--|--|--|--|---|--|---------------------------------------|
|  |            |                |   | Verification<br>Method  |             |  |  | When To<br>Check   | What to Check<br>Against                         | What to Check<br>Against  | Accountable<br>Party<br>Signoff  | Specificati<br>ons<br>Good/No<br>Good |
| -  |            |                |   | Use a dial indicator to verify perpendicula rity between the stuffing box face and the shaft O.D. |             | Q <sub>1</sub>                                   | <b>?</b>   | 5<br>Performed<br>in shop<br>before<br>equipmen<br>t is<br>disassemb<br>led. | Stuffing Box<br>Face<br>Perpendicularity         | Manufacturers Specifications: Stuffing Box Face Perpendicularity Recommended .003* TIR max. | Example:<br>Seal Mfg<br>assumes<br>responsibilit<br>y for<br>performance | Value                                 |
| E  |            |                | Actual  | 0002  | .002005     | .005010  | .010020  | .020 -<br>.030   |  |   |  |                                       |
| 11 1 1 1 1 1 1 1.  |            |                | Actual  | 912 days  | 386 days    | 196 days   | 121 days   | 45 days  |  |   | Mfg is held accountable  |                                       |
| 1  |            |                |   |   |             |  | *  |  |  |   |  |                                       |
| <del>†                                     </del>        |            | <del></del>    |   | <b>1</b>  |             |  |  | <del>                                     </del>                             |  |   | <del>                                     </del>                         |                                       |
| ≡  |            |                | Single Design<br>Double Design                      |   |             |  |  |  |  | * = the recorded  | value that appli   | lies to your                          |
| կայ գույ այլ այլ լար գույ<br>կոմ Հեռե Կոու կոու կոմ վոյն | ,          | 1 [            | Cartridge Design Component Design Stationary Design | 0   | 0           | 0  |  |  | 3  |   |  |                                       |
| 14   |            |                | Rotary Design                                       | 25  | 50          | 75   | 100  | 200  |  |   |  | <u> </u>                              |
| <b>T</b>   |            | 1 1            |   | <b></b>   | <u> </u>    | <u>'</u>   | <b></b>  | <del></del>  | <del> </del>                                     | <del> </del>  | <del></del>  |                                       |
| <b>f</b> i   |            |                | Balanced Design<br>Unbalanced Design                | <b></b>   | <b>/</b>    |  | <del> </del>                                     | <del> </del>   | <del>                                     </del> | <del> </del>  | <del> </del>   | <del></del>                           |
| General  |            | Cartridge<br>& | Onbalanced Design                                   | <del>                                     </del>  | f           | <del>                                     </del> |  | <del> </del>   | <del> </del>                                     | <del>                                     </del>  | <del> </del>   | <del> </del>                          |
| Design   |            |                | Tandem Design                                       | 1   | [ ·         |  |  | 1  |  |   |  |                                       |
|  | <b>i</b> 1 |                | Back to Back Design                                 |   |             |  |  |  |  |   |  |                                       |
|  |            | ( !            |   |   |             | ['   | <u> </u>   | Ţ  | <b>1</b>   | <b></b>   | <del> </del>   | <del></del>                           |
|  |            | 1 1            | Internally Mounted Design                           | <b></b>   | <b> </b>    | <del>                                     </del> | <del> </del>                                     | ——   | ╄──  | <del> </del>  | +  | +                                     |
|  | 1          | 1. 1           | Externally Mounted design                           | <b> </b>  | <del></del> | <del> </del>                                     | <del> </del>                                     | +  | <del> </del>                                     | <del> </del>  | <del> </del>   | +                                     |
| -  |            | 1 1            | Large Clearance Design                              | <del>                                     </del>  | <del></del> | <del></del>                                      | <del>                                     </del> | +  | <del>                                     </del> | <del> </del>  | <del></del>  | +                                     |
|  |            | 1 1            | Tight Clearance Designs                             | 1   |             |  | <del>                                     </del> |  | 1  |   | †  | 1                                     |
|  |            | 1 /            |   |   |             |  |  | <b>T</b>   |  |   |  |                                       |
|  |            | 1 '            | Double seal with pumping ring design                |   |             |  |  |  |  |   |  |                                       |
|  | 1          | 1 '            | Double seal without pumping ring design             |   |             |  |  |  |  |   | <u> </u>   |                                       |
|  | 1          | 1 - l          |   |   | L           |  | <u></u>  | ــــــــــــــــــــــــــــــــــــــ                                       | <u></u>  | <u></u>   | <u> </u>   |                                       |

FI6.4

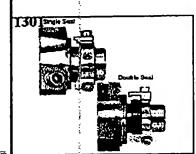
-*40* 

To perform a seal failure analysis, you have been provided photos for all seal types typically found in service. Simply click on the photo(s) that best identifies the conditions of the seal you are analyzing.

After all applicable pictures have been selected, click on the "When Failure Analysis Is Compl te Click Here T Go To Seal Failure Analysis Report and Add Additional Comments/Notes If Required." button to continue.

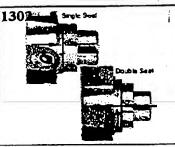
If safety issues allow, inspect parts before and after cleaning as photos require.

### Cartridge Seal: Seal Settings

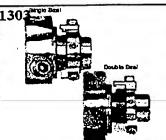


Incorrect settings due to seal being over compressed: Gap between lock collar and gland is too large.

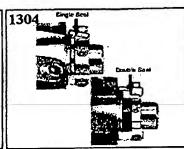
[Axial Direction]



Incorrect settings due to seal being under compressed: Gap between lock collar and gland is too small. (Axial Direction)

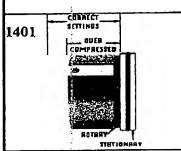


Incorrect settings due to gland face to shaft/sleeve not being perpendicular.

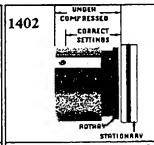


Incorrect settings due to shaft/sleeve being off centered to gland. Radial off-centering (up, down, left or right) between shaft/sleeve and gland ID

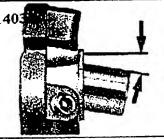
#### Component Seal; Seal Setting



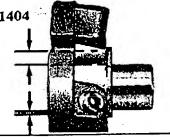
Incorrect setting due to seal being over compressed: Setting of rotary unit is wrong causing the seal to be over compressed.



Incorrect setting due to seal being under compressed: Setting of rotary unit is wrong causing the seal to be under compressed.

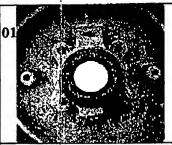


Incorrect setting due to gland face to shaft/sleeve not being perpendicular.



Incorrect setting due to gland not being centered to shaft.

#### Cartridge Seal: Environment



Scal area proked with product



Seal gland packed with product

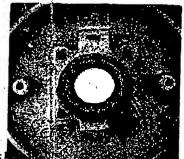


Carbon dust visible on front or ID of gland.



Crystalization/Solidification of product on atmospheric side of gland





## Seal area packed with product

identify the most RGA FP5RGA Form probable cause of failure Reason Cause Verification Corrective Actin Thermal sensitive fluids are Cartridge: Cartridge: Cartridge: Review materials of not maintained in liquid state Seal chamber temperature is raised or Verify the actual solidification point of construction recommendations. Review in the seal area, causing it to lowered beyond the solidification point the process fluid and the temperature API plan and heating and cooling plan build up on seal components of the process fluid. maintained in the stuffing box seal recommendations to control seal environment. Undissolved solids pack up in Cartridge: Cartridge: Cartridge: Review materials of the seal area and on the seal Heavy concentration of undissolved Verify concentration of the % of solids construction recommendations. Review solids are allowed to accumulate in the present in the process stream. components API plan and heating and cooling plan recommendations to control scal environment. Undissolved fibrous solids Cartridge: Cartridge: Cartridge: Review materials of pack up in the seal area on the Heavy concentration of fibrous solids Verify concentration of the % of solids construction recommendations. Review O scal components are allowed to accumulate in the back present in the process stream. API plan and heating and cooling plan ħ cover/stuffing box. recommendations to control scal environment. N Thermal cycling resulting in Inferior Casing Design For Please confirm that an inferior casing Replace with a superior casing design premature seal failure. Temperature Control design for temperature control is being for temperature control. used. Thermal sensitive fluids are Component: Component: Component: Review materials of not maintained in liquid state Seal chamber temperature is raised or Verify the actual solidification point of construction recommendations. Review in the scal erca, causing it to lowered beyond the solidification point the process fluid and the temperature API plan and heating and cooling plan build up on scal components of the process fluid. recommendations to control seal maintained in the stuffing box seal environment. area.

|   |  |        |           |  |               |               |   |                  |                  |                   |               |     |                 |                   |               |                     |   |                           |                      |                     |                        |   |                                      |                     |      |                   |           |                      | ;                  |               |                                  |              |                 |                 |     |                                 |   |          |  |           |  |       |                  |                       |                   |       |               |                                      |  |                 |
|---|--|--------|-----------|--|---------------|---------------|---|------------------|------------------|-------------------|---------------|-----|-----------------|-------------------|---------------|---------------------|---|---------------------------|----------------------|---------------------|------------------------|---|--------------------------------------|---------------------|------|-------------------|-----------|----------------------|--------------------|---------------|----------------------------------|--------------|-----------------|-----------------|-----|---------------------------------|---|----------|--|-----------|--|-------|------------------|-----------------------|-------------------|-------|---------------|--------------------------------------|--|-----------------|
| Petuld<br>To                                      | 1 de  | ž      | T         |  | Ţ             | T             | Ţ | П                | T                | T                 | T             | П   |                 | T                 |               | T                   | Τ |                           | T                    | T                   | T                      | Ī | Ī                                    | Γ                   | П    | T                 | T         | Ī                    |                    |               | Τ                                | Ţ            | Γ               | Π               | Ī   |                                 | Γ   |          | П  | T         |  | П     | П                | T                     | T                 | T     | Ť             |                                      | Π  | ě               |
| Repart  | Indendual Stol   | . 1    | ŀ         |  |               |               |   |                  |                  |                   |               |     |                 |                   | I             | Ι                   | I |                           |                      |                     | I                      | T |                                      |                     |      | T                 | T         | T                    | П                  |               | Ť                                | T            | T               | П               |     |                                 | T   |          | П  | 1         |  | П     | 7                | 1                     | 1                 | 1     | Ť             |                                      |  | žôž             |
| Decide on Repair Rebuild<br>of product or service | West Parie<br>Average 50s  |        | •         |  |               |               |   | 200              |                  |                   | 20.00         | 100 | 13. Uh. ii.     |                   |               |                     |   |                           | 7                    | 3111                |                        |   |                                      | 11.0                | 10.7 |                   |           |                      | 111                | Arrhering     |                                  |              |                 | 11.1            | 100 |                                 |   |          |  |           |  | 34.00 | 11.              |                       |                   |       |               |                                      |  | 19%             |
| enalys:s  | Indmidual<br>Staff Level   | 1      | +         |  | 7             | Ŧ             |   | H                | 7                | Ŧ                 | F             | H   | $\exists$       | 7                 | T             | F                   | F | H                         |                      | 1                   | Ŧ                      | Ŧ | Ŧ                                    | F                   |      | Ŧ                 | T         | F                    | H                  | 7             | 7                                | Ŧ            | F               | H               | 1   |                                 | -   | _        |  | 1         |  |       | 1                | 1                     | 1                 | Ŧ     | Ŧ             |                                      |  | 7               |
| Perform Analysis                                  | A SECTION AND ADDRESS OF THE PERSON ADDRESS OF THE PERSON AND ADDRESS OF THE PERSON ADDRESS OF |        | Ţ         | *  | 1             | Ť             | Ì | П                | 1                | T                 |               | П   |                 |                   | Ì             | T                   | Ī |                           | 1                    | 1                   | Ì                      | T | T                                    |                     | 1    | T                 | T         | T                    | H                  | 1             | 1                                | T            | İ               | П               |     |                                 | T   |          | 1  | Ť         |  |       | 1                | 1                     | †                 | t     | T             |                                      | F  | 1               |
| Tation I  | Indiradual<br>Stell Level  | 1<br>1 | †         |  | †             | ‡             | L | H                | ‡                | †                 |               |     | 1               | †                 | †             | t                   | ļ | Ц                         | #                    | +                   | ‡                      | † | ļ                                    |                     | 1    | ‡                 | ļ         | ļ                    |                    | 1             | ‡                                | t            |                 |                 |     |                                 | t   |          | +  | +         | _  |       |                  | †                     | +                 | ‡     | †             |                                      | -  |                 |
| Assess Erformation                                | Washing<br>Asserted  | 1 4    | t         |  | †             | t             | H | $\parallel$      | †                | t                 | +             | Н   | +               | +                 | +             | t                   | f | H                         | $\dagger$            | $\dagger$           | $\dagger$              | t |                                      | H                   | +    | $\dagger$         | $\dagger$ |                      | H                  | -             | $\dagger$                        | +            | $\mid$          | H               | +   |                                 | $\dagger$   | 1        | +  | $\dagger$ |  |       | +                | +                     | +                 | +     | $\dagger$     |                                      | 4.   | 1               |
|   | Podendusi An<br>Stall Level  | k<br>k | +         |  | ‡             | +             | L | H                | ‡                | $\downarrow$      |               |     | +               | +                 | ‡             | t                   | F |                           | +                    | $\dagger$           | $\dagger$              | + | +                                    | Н                   | 1    | +                 | +         | Ļ                    | Н                  | 1             | $^{\dagger}$                     | L            | L               | Ц               | 1   |                                 | L   |          | +  | ‡         |  |       | 1                | +                     | $\frac{1}{4}$     | +     | +             |                                      |  | 1               |
| the Informa<br>Make Purcha<br>Decinion            | West Jees<br>Avenge 20th Extendant<br>Level (2011 Level  | į      | $\dagger$ |  | $\dagger$     | ╁             |   | H                | $\dagger$        | +                 |               | Н   | +               | +                 | $\dagger$     | ŀ                   | - | H                         | $\dagger$            | +                   | $\dagger$              | ╁ | +                                    | Н                   | +    | +                 | +         | H                    | Н                  | +             | +                                | +            | H               | H               | 1   | _                               | $\vdash$  | +        | +  | +         | _  | 4     | +                | +                     | +                 | +     | +             | _                                    | ें विद्  | 1               |
|   | Indindual Ave<br>Stoll Level   | 1      |           |  | $^{\dagger}$  | t             |   |                  | 1                | ŀ                 | L             |     | 1               | 1                 | $\downarrow$  | L                   | L |                           | +                    | 1                   | $\frac{1}{1}$          | ļ | t                                    |                     | +    | +                 | l         | Ė                    |                    | $\frac{1}{2}$ | $\frac{1}{1}$                    | $\downarrow$ | L               | Н               |     |                                 | L   |          | +  | +         |  |       | 1                | $\frac{1}{2}$         | +                 | $\pm$ | ł             |                                      |  |                 |
| Analyze Construrts                                | Was June<br>Avenge 346 Indi  | .1     |           |  | +             | ł             | Н | H                | +                | ╁                 | L             |     | +               | t                 | $^{+}$        | H                   | L | H                         | +                    | +                   | +                      | ł | ł                                    | H                   | +    | +                 | ł         | H                    | H                  | +             | +                                | +            | H               | H               | +   |                                 | L   | $\dashv$ | 1  | +         | -  | 1     | +                | +                     | 1                 | +     | $\frac{1}{1}$ | _                                    | 1        | 1               |
| ₹   | 3 1 2  |        | 1         |  | 1             | $\downarrow$  | Ц | Ц                | 1                | Ļ                 | L             | Ц   | 4               | +                 | 1             | ╀                   | L | Ц                         | 4                    | 4                   | 1                      | Ļ | $\downarrow$                         | Ц                   | 4    | 1                 | ļ         | L                    | Ц                  | 4             | 1                                | ╀            | L               | Ц               | 4   |                                 | L   | 4        | 4  | 1         |  |       | 4                | 1                     | 1                 | 1     | ļ             |                                      |  | •               |
|   |  |        |           | Product/Service<br>Stell Levi Rating<br>Required<br>(Eumple A<br>Component | Mediunica Sen |               |   |                  |                  |                   |               |     |                 |                   |               |                     |   |                           |                      |                     |                        |   |                                      |                     |      |                   |           |                      |                    |               |                                  |              |                 |                 |     |                                 |   |          |  |           |  |       |                  |                       |                   |       |               |                                      |  | in the same     |
|   |  |        |           |  |               |               |   |                  |                  |                   |               |     |                 |                   |               |                     |   | engh.                     | T) III               | 8                   | 3 6                    |   | ng design                            | Amping ring design  |      |                   |           |                      |                    |               | Source Inch                      |              |                 |                 |     | e Dust Tengersteal Fluxth Holes | Single Seal with Small Straight Drill Holes Or No Flush |          | Double seal with two fligh bales on some nuffice |           | Double seal with two fluch holes 180 degrees apart |       |                  |                       |                   |       |               | 4 certified glands in repairfrebaild | Practice of not using OEDs certified glands in |                 |
|   |  |        |           |  | Surcle Design | Double Design |   | Cartridge Design | Companies Design | Stationary Design | Rotary Design |     | Balanced Design | Olivianies Design | Tandem Design | Back to Back Design |   | Internally Mounted Design | Externally Mounted o | Large Clearance Dec | Data Clearance Designs |   | Double seal with pumping ring design | Double seal without | 1    | Low Balance Ratio |           | Spring Londed Design | Metal Bellows Deng | 4             | High Spring Load Per Source Inch |              | Wide Face Width | Narow Face Widh |     | Single Seal with Larg           | Single Seal with Smal                                   | Holes    |  |           | Double seal with two                               |       | 11 655 Metallung | Hadellow C. Metalling | Tutmum Metalhurov |       |               | Practice of using OE                 | Practice of not using                          | replient counts |
|   |  |        |           |  |               |               | _ |                  |                  |                   | _             |     |                 |                   |               |                     |   | 4                         | :                    | Compon              | f                      | _ | _                                    | _                   |      |                   | _         |                      |                    |               |                                  |              |                 |                 | T   |                                 | Cartride  | •        | a garage   |           |  | T     | Certrage         | : 8                   | 5                 | ı     | Cartride      |                                      | Compos   | Ī               |
|   |  |        |           |  | I             |               |   |                  |                  |                   | _             |     |                 |                   |               |                     |   |                           |                      |                     |                        |   |                                      |                     |      |                   |           |                      | _                  |               |                                  |              |                 |                 |     |                                 |   | Denga    |  |           |  |       | 7                | construc              | ğ                 |       | Kepar         | Rebuild                              | 27   | Procedu         |
|   |  |        |           |  |               |               |   |                  |                  |                   |               |     |                 |                   |               | 5                   | ی | Ū                         | eneral               | E E                 |                        | _ |                                      |                     | _    |                   |           |                      |                    |               |                                  |              |                 | 1               | T   |                                 |   |          |  |           |  | 1     |                  |                       |                   |       |               |                                      |  |                 |

|                              |                          |  |             | Accept         |                |             | 94.       | 11.          |                        | i pa        |                    | i car               | Ϊij       | 140.K       |   | 11.       | 100         | 10.00  |       |  | arga :       | 1  |            |         |             |  |            |   | F           |   |             | T             | Π  | T            | T   |         |      | T            | 1   | T            | П            | Т  | П         | П   | Т           | 1   |   | Π            |
|------------------------------|--------------------------|--|-------------|----------------|----------------|-------------|-----------|--------------|------------------------|-------------|--------------------|---------------------|-----------|-------------|---|-----------|-------------|--|-------|--|--------------|--|------------|---------|-------------|--|------------|---|-------------|---|-------------|---------------|--|--------------|---|---------|------|--------------|---|--------------|--------------|--|-----------|---|-------------|---|---|--------------|
|                              |                          |  | TRY .       | La Lafe Besson |                |             |           |              | 1 2                    | WILLIAM III |                    | 100                 |           | ding co.    | 11.   |           | 1.          |  | 11.11 |  | i.           |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   |              |              |  |           |   |             |   |   |              |
|                              |                          | 1                                      | Normal N    | 1              | 2002           |             |           |              | AMP E                  |             |                    | in the second       |           |             | Laure L   |           |             |  |       |  |              |  |            |         |             |  | 0 7        | 1   |             |   |             |               |  | Ш            |   | red III | 5 6  | 88           | $\coprod$   |              |              |  |           |   |             |   |   |              |
|                              | Orașboil                 | 4                                      |             |                |                | Ц           |           |              |                        | Ц           | 1                  | Ц                   |           |             | Ц   | 1         |             | 1  |       | Ц  |              |  |            |         |             |  |            | Ц   |             | Ц   |             |               | Ц  | Ц            | Ц   |         |      | _1_          | $\prod$   | _            | Ц            | ╧  |           |   |             |   |   | Ц            |
| 4                            | ra de                    | 4                                      | $\prod$     |                | Ц              | Ш           |           |              |                        | Ц           |                    | Ц                   |           |             | Ц   |           | Ц           |  |       | Ш  |              |  |            |         |             | Ш  |            |   | 1           |   |             |               |  |              | Ц   |         |      |              |   |              |              |  |           | ŀ   |             |   |   | $\prod$      |
| 3                            | Xabrez                   | 4                                      | $\parallel$ |                |                | $\prod$     | 1         | Н            |                        | $\coprod$   |                    | Ц                   | Щ         | 1           | Ц   | 1         | Ц           | 1  | Ц     |  | 1            | Ц  |            | 4       |             |  |            | Ц   | 1           |   | Ц           | 1             | П  |              |   | Ξ       | - :  | _            | $\prod$   | 1            |              |  | Ц         |   |             |   |   | Ц            |
|                              | Teflon After             | ×                                      | +           | H              | H              | Н           | +         |              | 200                    | H           | t                  | H                   |           |             | H   | t         | H           | ra (n)   |       | 4 1  | +            | H  | +          | H       | -           |  | +          | H   | +           | Н   |             | +             |  | H            |   |         |      | +            |   | +            |              | A103   |           |   |             |   |   | Н            |
|                              | ž.                       | 1                                      |             |                |                |             | 1         | $\parallel$  |                        | Ц           | 1                  |                     |           | 1           |   | 1         |             | 1  |       | Ц  | 1            |  | <u> </u>   |         |             |  | t          |   | 1           |   |             | 1             |  |              |   | · ·     | . 49 | _            |   | #            |              | 1  |           | $\downarrow$  |             |   |   | Ħ            |
|                              | Value                    | 7                                      | H           | L              | $\parallel$    | $\perp$     | +         | H            | +                      | H           | +                  | $\vdash$            | H         | $\parallel$ | H   | +         | H           | +  | H     | +  | +            | H  | +          | H       | +           | H  | +          | H   | +           | H   | $\parallel$ | +             | H  | $\parallel$  | H   |         | • •  |              | ${\mathbb H}$   | +            | +            | +  | H         | +   | $\parallel$ | -   | _   | H            |
| i                            | Cers Chrome<br>nue Oxide |  | H           | <br>           | H              | $\parallel$ | +         | H            | $\parallel$            | H           | +                  | ╫                   | H         | +           | H   | ╁         | H           | +  | H     | +  | +            |  | +          | H       | +           | H  | +          | H   | +           | H   | H           | +             | $\parallel$  | +            | $\dashv$  |         | 1 10 | -            | H   | +            | H            | +  | H         | +   | +           | +   |   | H            |
| 74                           | Pliked<br>To             | Ì                                      | $\parallel$ |                |                |             |           |              |                        |             | Ţ                  |                     |           |             |   | 1         |             | I  |       |  | 1            |  |            |         | Ţ           |  | 1          |   | 1           |   |             | 1             |  |              |   |         | Ā    |              |   | 1            |              | 1  |           |   |             |   |   |              |
|                              | Nyckel<br>Bonded<br>TC   |  | $\coprod$   | _              |                | $\parallel$ | 1         | Н            | 1                      | $\prod$     | $\downarrow$       | $\parallel$         |           | 4           | $\prod$   | 1         | $\prod$     | +  | Ц     | $\parallel$  | $\downarrow$ |  | -          |         | -           |  | 1          |   | 1           | $\coprod$   | $\coprod$   | 1             | $\prod$  | $\parallel$  | $\coprod$   |         | · .  |              | $\prod$   | $\downarrow$ | $\sqcup$     | _  | $\coprod$ |   | 4           | 4   |   | Ц            |
|                              | ed Hunded<br>SC          | H                                      | $\prod$     | _              | H              | $\coprod$   | +         | $\mathbb{H}$ |                        | $\parallel$ | +                  | $\parallel$         | H         | +           | H   | +         | H           |  |       | $\parallel$  | +            | H  | +          | H       |             |  | +          | $\ $  | +           | $\parallel$   | $\parallel$ | $\downarrow$  | H  | $\parallel$  | $\parallel$   |         |      | 1            | $\coprod$   | +            | $\parallel$  | +  | H         |   | +           | -   |   | $\mathbb{H}$ |
|                              | Alpha<br>Surfered<br>SC  | 4                                      | $\parallel$ |                | H              | H           | +         | $\mathbb{H}$ | +                      | H           | +                  | $\parallel$         | H         | +           | H   | +         | H           | +  | H     | $\parallel$  | +            | H  | +          | H       | +           | H  | +          | +   | +           | H   | H           | ╀             | H  | +            | $\dashv$  |         |      | +            | H   | +            | +            | +  | H         | +   | +           | +   |   | $\mathbb{H}$ |
| 7.3                          | Manum Carbon             | 4                                      | H           | $\vdash$       |                | H           | $\dagger$ | H            | $\dagger$              | H           | $\dagger$          | $\parallel$         | H         | +           |   | +         | H           | 1  |       | $\parallel$  | 1            |  | +          | H       | $\dagger$   | H  | $\dagger$  | Н   | +           | Н   | H           | $\dagger$     | H  | +            | H   |         |      | -            | $\parallel$   | $\dagger$    | +            | $\dagger$  | H         | +   | $\dagger$   |   |   | H            |
| i                            | Hast C Tuan              | H                                      | H           | $\vdash$       | H              | H           | +         | H            |                        | H           | +                  | $\parallel$         | +         | +           | H   | +         | H           | +  |       | $\parallel$  | +            | H  | 1          | H       | +           |  | $\dagger$  |   | +           | $\parallel$   | $\parallel$ | $\dagger$     | $\parallel$  | $\parallel$  | H   |         |      | +            | H   | +            | $\parallel$  | +  | H         | _   | $\parallel$ | $\dashv$  |   | H            |
|                              | Alloy 20 H               | 1                                      | Ħ           | -              | $\parallel$    | $\parallel$ | †         |              |                        | H           |                    | Ħ                   | $\dagger$ | 1           |   | t         | Ħ           | 1  |       |  | ;            |  |            |         |             |  | †          |   | 1           |   | Ħ           |               |  |              | Ħ   |         |      |              | $\parallel$   | $\dagger$    | Ħ            | 1  |           | $\dagger$   | H           |   |   | П            |
|                              | Y 55 91 (                | Ĭ                                      |             | 100            |                |             | •         |              |                        |             |                    |                     |           |             |   |           |             |  |       |  |              |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   |              |              |  |           |   |             |   |   |              |
| require<br>al                | Double                   | Double                                 |             |                |                |             | ŀ         |              |                        |             |                    |                     |           |             |   |           | $\  \ $     |  |       |  |              |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   |              |              |  |           |   |             |   |   |              |
| Cl & C? requee<br>duble seal | ă<br>                    |  |             |                |                |             |           | :            |                        | Ц           | $\downarrow$       |                     |           | 1           | Ц   | 1         | Ц           | 1  | Ц     | $\parallel$  |              |  | 1          | Ц       | 1.          |  | 1          |   | 1           | Ц   |             | _             | Ц  | Ц            | $\coprod$   |         |      | 1            | Ц   | 1            |              | 1  |           |   |             |   |   | Ц            |
|                              | Single                   |  |             |                |                |             | 1         |              |                        |             |                    |                     |           |             |   | l         |             |  |       |  |              |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   |              |              |  |           |   |             |   |   |              |
|                              |                          | rndetions                              |             |                |                |             | Ī         |              |                        | $\prod$     |                    |                     |           |             |   | Ī         |             | Ī  |       |  |              |  |            | П       |             |  | Ī.         |   | Ī           |   |             |               |  |              |   |         |      |              | П   | T            |              |  |           |   |             |   |   | П            |
|                              |                          | Operating Consistents                  |             | T-9,94.9       | esi Attributes |             |           |              |                        |             |                    |                     |           |             |   |           |             |  |       |  |              |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   |              |              |  | $\ $      |   |             |   |   |              |
|                              |                          | Sym                                    |             |                | Seal           |             |           |              |                        |             |                    |                     |           |             |   |           |             |  |       |  |              |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   | ļ            |              |  |           |   |             |   |   |              |
|                              |                          |  |             |                | H              | $\perp$     | +         | H            | 1                      | H           | ╀                  | $\coprod$           | igert     | $\parallel$ | H   | ╁         | H           | $\downarrow$   | H     | $\perp$  | +            | $\prod$  | ╀          | $\prod$ | +           | H  | +          | H   | +           | ļ   | $\parallel$ | +             | H  | +            | H   |         |      | 3            | $\prod$   | +            | $\parallel$  | +  | $\prod$   | +   |             | -   |   | H            |
|                              |                          |  |             |                |                |             |           |              |                        |             |                    |                     |           |             |   |           |             |  |       |  |              |  | ļ          |         |             |  |            |   |             |   |             |               |  | -            |   |         |      |              |   |              |              |  |           |   |             | reals   | 5   |              |
|                              |                          | •                                      |             |                |                |             |           | . manage     |                        |             |                    |                     |           |             |   |           |             |  |       | reals  |              |  |            |         |             |  | ŀ          |   |             |   |             | c             |  |              |   |         | ٠.   | 1            |   |              |              |  |           | 1011  |             | component   | xmponent se   |              |
|                              |                          |  |             |                |                |             | 12.1      | 1            |                        |             |                    |                     |           |             |   |           |             |  |       | onera seuls<br>s componera   |              | Tersion  | _          |         | 8           | 8  |            | rpression   | uo:         | 100   |             | Inder Tensio  | SSION  |              | Ę   |         |      | Tension      |   |              | an least on  | restion  | $\ $      | d component   |             | atridge and   | rides and co  |              |
|                              |                          | Action, Ten G10 F                      |             |                |                |             | and o     | New Hill     |                        |             |                    |                     |           | t of        | purfrebuid  | OURSESSEE | nston       | ompression<br>msion  |       | cartridge an   |              | eral Under   | Compressio |         | Tention     | Compressi  | Tension    | J Ynder Cor   | I Under Ten | Under Ten   |             | nder Comprise | nder Compe   | nder Tension | Compression   |         | ·    | stens 1 Inde | Tension   | 100          | Under Tensiv | Under Comp   |           | e and comp  |             | butting on c  | thing on car  | P            |
|                              |                          | Action                                 |             |                |                |             |           |              |                        |             |                    |                     |           |             | d faces the   | Though C  | ul Under Te | Last Under C.  |       | ed faces on  | 100          | and Face M   | enal Under |         | Menul Under | atenut Unde  | tend "hote | Face Makery   | Face Makern | Fice Material   |             | SC Hard Fix   | Material   | Material     | tenal Under   |         |      | ind Face M   | tenal Unde  | Art and Art  | ce Material  | ce Material  |           | es on cartnd  |             | th corrosion  | corrosions  |              |
|                              |                          | •                                      |             |                |                |             |           | - Pelon      |                        |             |                    |                     |           | 1           | De certific   | Two Mater | Face Mater  | Fice Male<br>Fice Male   |       | of seal face   |              | d Cersmic P  | rd Face Ma |         | Land Face M | Grd Face M   | ind Face M | ed TC Hard  | ed TC Hard  | ed TC Hard  |             | C Hard Floor  | CHarden  | C Hard Fac   | ard Face Mu   |         | 1.5  | d Alpha SC   | ard Face M.   | 4            | ade Hard Fa  | ade Hard Fa  |           | apped hard a  |             | real faces w  | d faces with  |              |
|                              |                          | internal<br>Projection                 |             |                |                | Model       | talkara.  | deta largy   | Hastelloy C Metallurgy | (A)         | dallurgy           | Alloy 20 Metallurgy | Vetalhery | 130         | Produce of not using OEM certified faces in repurfrebuild | of motors | Carbon Sol  | Two Piece Carbon Soft Face Material Under Compression<br>Two Piece Carbon Soft Face Material Under Tension |       | Produce of replacing soft seal faces on carindge and component seals<br>Practice of reusing relapped soft seal faces on carindge and component seals |              | One Piece Committee for the parents of the Committee of t | Ceramic H. |         | Plated IC   | Two Piece Plated TC Hard Face Material Under Compression | PlaceTC    | One Piece Nick Bonded TC Hard Face Makerial Under Compression | Nick Bond   | Two Piece Nick Bonded TC Hard Face Material Under Tension |             | Kun Bond :    | Two Piece Kan Band SC Hard Face Material Under Compression | Km Bond      | One Piece Alpha SC Hard Face Material Under Compression |         |      | Then Walle   | I WO PIECE AIDIN DO FING PARCHIA UNDER COMPRESSION<br>TWO PIECE AIDIN DO HAY O FACE MAKENIA Under Tension |              | Chrome O     | Two Piece Chrome Onde Hard Face Material Under Compression<br>Two Piece Chrome Onde Hard Face Material Under Totalon |           | Practice of replacing hard seal faces on cartridge and component seals<br>reactice of retuing relapsed hard seal faces on cartridge and component seals |             | Practice of replacing seal faces with corross on pitting on cartridge and component seals | Practice of returns seal faces with corresponding to certains on certains and component seals |              |
|                              | 2                        | 7 (<br>)<br>()<br>()<br>()<br>()<br>() |             |                | 7770           | nen nen     | N ESS IV  | Alloy 20     | Titening               |             | . 316SS Metalbargy | Alloy 20            | Tdamm     |             | Predice   | i d       | One Piec    | Two Piec   |       | Prictice   |              | One Piec   | Two Piec   |         | One Piec    | Pro Piec   | Two Piec   | One Piec  | One Piec    | Two Piec  |             | Se Pic        | Two Piec   | Two Piec     | One Piec  |         | - 1. | One Prec     | Two Piec  |              | One Piec     | Two Piec   |           | Practice  |             | Produce   | Protice   |              |
|                              | 36,                      | Pre                                    |             | į              |                |             |           |              | d Component            | $\parallel$ | t Cartagas         |                     |           | $\prod$     | _   | _         | _           |  |       |  | _            |  |            |         | _           | _  |            |   |             | Cartindge   | Сопролен    | -             |  | 2            |   |         |      |              |   |              |              |  |           |   |             |   |   |              |
|                              | `                        | Process Fluid                          |             | 70             |                | H           |           | of of        | 8                      | Ц           | Manualt            |                     |           | Ц           | _   |           |             |  |       |  |              |  |            |         |             |  |            |   |             |   |             |               |  | 18.0         | Face  | of      | 8    | _            |   |              |              |  |           |   |             |   |   |              |
|                              |                          |  |             |                | Ц              |             |           | 1            | 7                      | `           |                    | Street or           | E .       | 5           | -   |           |             |  |       |  | _            |  |            |         |             |  |            |   |             |   |             |               |  |              |   |         |      |              |   |              |              |  |           |   |             |   |   |              |

| Product Has<br>Viscosny <<br>15000 |              |           |   |             |   |   | I |      |   |   |   |   |   |           |   |     |              | I   |   |         |   |            |     |   |            |           |        |   |   |          |    |    |   |   |    |   |     |          | $\prod$ |   |         | brack   |           |   |   |         |   |  |
|------------------------------------|--------------|-----------|---|-------------|---|---|---|------|---|---|---|---|---|-----------|---|-----|--------------|-----|---|---------|---|------------|-----|---|------------|-----------|--------|---|---|----------|----|----|---|---|----|---|-----|----------|---------|---|---------|---------|-----------|---|---|---------|---|--|
|                                    | ļļ           | Ī         | ä   |             |   |   |   |      |   |   |   |   |   |           |   |     |              |     |   |         |   | П          |     |   |            |           |        |   | L |          | 1  | L  |   |   | ğ. |   | Ц   |          | Ц       | L | Ц       | ┙       |           | Ц |   | ┸       | L |  |
|                                    | g er ellh    | President | Egypta Br.  |             |   |   |   |      |   | H |   |   |   |           |   |     |              |     |   |         |   |            |     |   | - 140      |           |        |   |   | ily<br>i |    |    |   |   |    |   |     |          | Ш       |   |         |         |           |   |   |         |   |  |
|                                    |              | Ţ         | ä   |             |   |   |   |      |   |   |   |   |   | H         |   |     |              |     |   |         |   | П          | T   |   |            | T         | Π      |   | ľ |          |    | T  |   |   | 1  |   | П   |          | LL.     |   | $\prod$ |         |           | П |   |         |   |  |
|                                    | en beryfa    | 3.4       | (L)   |             |   |   |   |      |   |   |   |   |   |           |   |     |              | 75  |   | 173,475 |   | The second |     |   |            |           |        |   |   |          | 3. |    |   |   |    |   |     |          | $\prod$ |   |         |         | 1.        |   |   |         |   |  |
|                                    | , E          |           | ä   |             |   |   |   |      |   |   |   | Г |   |           |   | 4   |              |     |   |         | 1 |            |     |   |            |           |        | 1 | Ι | П        | T  | Ŧ. |   |   |    |   | :   |          | $\prod$ |   | П       | $\perp$ |           |   |   | $\perp$ |   |  |
|                                    | II decisio   | ,<br>,    | E .   |             |   |   |   |      |   |   |   |   |   |           |   |     | The State of |     |   | Sec. of |   |            |     |   |            |           | . 1100 |   |   |          | 7  |    |   |   |    |   |     |          | $\prod$ |   |         | $\prod$ |           |   |   |         |   |  |
|                                    | andt d       | 1         | 2<br>2<br>3<br>3  |             |   |   |   |      |   |   |   |   |   |           |   |     |              |     |   |         |   |            |     |   | THE PERSON |           |        |   |   |          |    |    |   |   |    |   |     |          |         |   |         | floor   |           |   |   |         |   |  |
|                                    | 2 2 2 2      |           | Energy'   |             |   |   |   |      |   |   |   |   |   |           |   |     |              |     |   |         |   |            |     |   |            |           |        |   |   |          |    |    |   |   |    |   |     |          |         |   |         |         |           |   |   |         |   |  |
|                                    |              | Ī         | I R   |             | ı | Ħ |   | Ħ    |   | t |   |   | Ī |           |   | ı   | Ħ            |     |   |         |   |            |     |   | Ħ          | 1         | 7      |   |   | П        | 1  | 1  |   | П |    | 1 |     |          | П       | 1 | П       | T       | T         | П | T | 1       | T |  |
| 12000                              | A, O rese    | 4)0 100   | 15 E  |             |   |   |   |      |   |   |   | Ī |   |           |   |     |              | T   |   |         | 1 | П          |     | ľ | П          |           |        | 1 | Ī |          | 1  | T  |   |   | 1  | T | 3.  |          | П       | T | П       | T       | T         | П |   |         |   |  |
| Ŷ                                  | E N          | Ħ,        | Ţ   | H           |   |   | ľ | П    |   | t | П | t | Ī |           |   |     |              | -11 |   |         |   |            |     |   |            | 1         | Ħ      | + | 1 |          |    | +  | , | П | ✝  | 1 |     |          | П       | 1 | П       | T       | Ť         | Ħ | Π | Ť       | T |  |
| Product Has Viscouty > 15330       | D STATE      | L.        | 3 Ja Ja   |             |   |   |   | 1300 |   |   |   | l | Ī |           | Ī |     |              |     |   |         | İ |            | 1 - |   |            |           |        | 1 | 1 |          | ů. | 1  |   |   |    | 5 | 0.0 |          | I       | T | П       |         | $\dagger$ | П |   | 1       | T |  |
| 3                                  | 1            | H         | اَيا  | ij          | 1 | Ħ | 1 |      | Ħ | 1 |   | T | 1 |           |   | t   | 1            |     | 1 | П       |   | П          | †   | Ħ | H          | $\dagger$ | Ħ      | 1 | t | П        | 7  | t  | Τ | П | 7  | † | П   | er eller | Π       | T | П       | T       | T         | П |   | †       | T |  |
|                                    | fe factresse |           | aroda,  | TO THE      |   |   |   |      |   |   |   | ŀ | l |           |   |     |              |     |   |         |   |            | 100 | 1 |            |           | F.     |   |   |          |    |    |   |   |    |   | 7   |          | П       | T | Ħ       |         |           | П |   | Ť       | ľ |  |
|                                    | I ESONGES    |           | manil Cycris Martin Disput Br. Cocket Br. Cas S. Dr. Barry West. Sweet Br. Mary R. Euronn Br. | Carry state |   |   |   |      |   |   |   | l |   | 1 mm 1 mm |   | 11. |              |     |   |         |   | П          | 1   |   |            |           |        | 1 | T |          | 1  | T  | Ī |   |    | Ī |     |          |         | T | $\prod$ | T       | T         |   |   | İ       |   |  |
|                                    | decrease In  | 4         | S C   |             |   |   |   |      |   |   |   |   |   | The same  |   |     |              |     | ő | - 1     | İ | j.         |     |   |            |           |        |   |   | 4.       |    |    |   |   |    |   |     |          |         |   | $\ $    | T       | T         |   |   | Ī       | T |  |
|                                    | 1 3          |           | 3   | Ħ           |   | П |   | T    |   |   |   |   |   |           | 1 |     | 3            |     | T |         |   | П          | 1   |   | П          | T         | Т      | T | T | П        | 1  | T  |   | П | 1  | T | П   |          | П       | T | П       | П       | T         | П | ٦ | 1       | 1 |  |

|             | Seal:   | T-9.9t.9                                      |
|-------------|---|---|
|             | * 1   | Product/Service Skill Leve<br>Rating Required |
|             | Specify   | 7.5   |
|             | Purchase  | 5   |
|             | Install with generic installation instructions    | 10  |
| G . 17: 16  | Install with engineered installation instructions | 5   |
| Seal Itself | Operate with generic operating instructions       | 5   |
|             | Operate with engineered operating instructions    | 2.5   |
|             | Disposal  | 2.5   |
|             | Sell  | 2.5   |
|             | Specify   | 2.5   |
| Repair /    | Purchase  | 2.5   |
| Rebuild of  | Repair  | 7.5   |
| Seal        | Disposal  | 5   |
|             | Sell  | 2.5   |
|             | Specify   | 7.5   |
|             | Purchase  | 2.5   |
|             | Install with generic installation instructions    | 7.5   |
| API Plans   | Install with engineered installation instructions | 2.5   |
| for Seal    | Operate with generic operating instructions       | 5   |
|             | Operate with engineered operating instructions    | 2.5   |
|             | Disposal  | 7.5   |
| =           | Sell  | 2.5   |

FI6.8

| -        | <b>.</b> .         |  |
|----------|--------------------|--|
| ٠,4      | AV3000175A (Seal)  | Seal fits with no modifications  |
|          | AV3200175EA (Seal) | Seal fits with no modifications  |
|          |                    | Special gland modifications required  Special sleeve modificatins required |
|          | 155<br>123         |  |
| Seal     |                    |  |
|          |                    |  |
|          |                    |  |
|          | <u>.</u>           |  |
|          |                    |  |
| ŀ        |                    |  |
|          |                    |  |
|          |                    |  |
| <u> </u> |                    |  |

These results come from the CA & SS from ESP

F16 9

|             | د  | Process Fluid          |
|-------------|--|------------------------|
|             | · ' ·  | Acetone; Tem <210 F    |
|             |  | System Recommendations |
| Recommende  | Single _   | _                      |
| d Seal Type | Double   | Double                 |
|             | 316 SS   | . A                    |
| Matalana    | Alloy 20   | A A                    |
| Metalurgy   | Hast C   | A                      |
|             | Titanium   | N                      |
|             | Carbon   | A                      |
|             | Alpha Sintered SC  | A                      |
|             | Rxn. Bonded SC   | . А                    |
|             | Nickel Bonded TC   | A                      |
| Faces       | Plated TC  | N                      |
| races       | Ceramic  | A                      |
|             | Chrome Oxide   | N                      |
|             | Viton  | N                      |
|             | EPR  | A                      |
|             | Teflon   | A                      |
| Elastomers  | Aflas  | N                      |
|             | Kalrez   | Α                      |
|             | Chemraz  | A                      |
|             | Graphoil   | A                      |
|             | C31- Mfg. Recommends The Useof A Model that supports an option two piece stationary head | No                     |
|             | Pumping Feature Required   | Yes                    |
|             | Quench & Drain Required  | ì No                   |

FI6.10

|       | ' '     |   | Work Force Average Skill Level |                                       | 5   |
|-------|---------|---|--------------------------------|---------------------------------------|-----|
|       |         | Analyze Constraints                             | Individual Skill Level         | John                                  | 7   |
| 1     |         |   | Individual Skill Level         | Mary                                  | 3   |
|       | •       |   | Work Force Average Skill Level |                                       | 5   |
|       |         | Gather Information To Make Purchasing Decision  | Indicated Chin I and           | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
|       |         |   | Work Force Average Skill Level | · · · · · · · · · · · · · · · · · · · | 5   |
|       |         | Assess Information                              |                                | John                                  | 7   |
|       |         | i   | Individual Skill Level         | Mary                                  | 3   |
| j     |         |   | Work Force Average Skill Level | -                                     | 5 . |
|       |         | Perform Analysis                                |                                | John                                  | 7   |
|       |         |   | Individual Skill Level         | Магу                                  | 3   |
|       | •       |   | Work Force Average Skill Level | <u> </u>                              | 5   |
| İ     |         | Decide on Repair/ Rebuild of product or service |                                | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
| 1     |         |   | Work Force Average Skill Level |                                       | 5   |
|       |         | Assess Safety Impact                            | I 411 CL-10 I                  | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
| 1     |         |   | Work Force Average Skill Level | <u>'</u>                              | 5   |
|       |         | Decide Safety Requirements                      |                                | John                                  | 7 ' |
|       | c .c    |   | Individual Skill Level         | Mary                                  | 3   |
|       | Specify |   | Work Force Average Skill Level |                                       | 5   |
|       |         | Assess Environmental Impact                     | To divide at Chill I and       | John                                  | 7   |
| ŀ     |         |   | Individual Skill Level         | Mary                                  | 3   |
|       |         |   | Work Force Average Skill Level | 1                                     | 5   |
|       |         | Decide Environmental Requirements               | La Californi Chilli I assal    | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
|       |         |   | Work Force Average Skill Level | •                                     | 5   |
|       |         | Assess QC Requirements                          | Individual Chill I and         | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
| l     |         |   | Work Force Average Skill Level | •                                     | 5   |
|       |         | Decide QC Requirements                          | Individual Skill Level         | John                                  | 7   |
|       |         |   | mulviquai Skiil Level          | Mary                                  | 3   |
| kill  |         |   | Work Force Average Skill Level |                                       | 5   |
| evel  |         | Assess Mfgs. Capabilities                       | Individual Chill I aval        | John                                  | 7   |
| vaila |         |   | Individual Skill Level         | Mary                                  | 3   |
|       |         |   | Work Force Average Skill Level |                                       | 5   |
| ble   |         | Decide on Mfg.                                  | Individual Chill I areal       | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
|       |         |   | Work Force Average Skill Level |                                       | 5   |
|       |         | Decide on Specifications                        | Latinita and Object to the     | John                                  | 7   |
|       |         |   | Individual Skill Level         | Mary                                  | 3   |
|       |         |   | Work Force Average Skill Level |                                       | 7   |
|       |         | Decide and Prepare RFQ                          |                                | Bill                                  | 10  |
|       |         |   | Individual Skill Level         | Ed                                    | 4   |
|       |         |   | Work Force Average Skill Level | -                                     | 7   |

|          | Purchase  | Receive RFQ Responses and Analyze               | Individual Skill Level   | Bill  | 10 |
|----------|-----------|---|--|---|----|
|          |           |   |  | Ed  | 4  |
| 1.       |           |   | Work Force Average Skill Level   |   | 7  |
|          | •         | Make Decision To Buy Product                    | I dividual Chin I and  | Bill  | 10 |
|          |           |   | individuai Skiii Levei   | Ed .  | 4  |
|          |           |   | Work Force Average Skill Level   |   | 6  |
|          |           | Assess equipment condition                      |  | Jim   | 9  |
|          | •         |   | Individual Skill Level   | Ray   | 3  |
| ŀ        | Install   | :   | Work Force Average Skill Level   | <del></del>   | 6  |
|          |           | Install Product                                 | Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Individual Skill Level  Individual Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Individual Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Individual Skill Level | lim   | 9  |
|          |           |   | Individual Skill Level   |   |    |
| <u> </u> |           |   | Work Force Average Skill Level   | INAY  | 3  |
| ŀ        |           | State of C. C. C. C. C. C. C. C. C. C. C. C. C. |  |   |    |
| į        |           | Startup of Equipment                            | Individual Skill Level   | Skill Level  Skill Level  Skill Level  Skill Level  Skill Level  Skill Level  Skill Level  Skill Level  Mike  Jeff  Verage Skill Level  Skill Level  Skill Level  Wayne | 10 |
| 1        | Operation |   |  |   | 6  |
|          |           |   | Work Force Average Skill Level   |   | 8  |
|          |           | Operation of Equipment                          | Individual Skill Level   |   | 10 |
| 1        |           |   | Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Mike Jeff  | Jeff  | 6  |
| <u> </u> |           |   | Work Force Average Skill Level   |   | 4  |
| ļ        | Disposal  | Disposal of Equipment                           | Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Wayne  Terry  Work Force Average Skill Level   | Wayne   | 6  |
|          |           | ····  |  | Тепту   | 2  |
| -        |           |   | Work Force Average Skill Level   |   | 4  |
|          | Sell      | Decide on Sale                                  |  | Sue   | 3  |
| 1        | ~~        |   | Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Work Force Average Skill Level  Individual Skill Level  Individual Skill Level  Individual Skill Level   | Lori  |    |

|        |                        |                | FJG. 12 A  |  |
|--------|------------------------|----------------|--|--|
| 7 Y    |                        | c              | 4 · · · · · · · · · · · · · · · · · · ·  | John Crane\T-9;9t;9                              |
| /. E   | example                | of some        | e of the data included in an "O Database" for an "O Resource" (Seals)  | Seal Attributes                                  |
|        |                        |                | Single Design  | Single   |
|        |                        |                | Double Design  |  |
|        |                        |                |  |  |
|        |                        |                | Cartridge Design Component Design  | Cartridge  |
|        |                        | -              | Component Design   |  |
|        |                        |                | Stationary Design  |  |
|        |                        |                | Rotary Design  | Yes  |
|        |                        |                | Balanced Design  |  |
|        |                        |                | Unbalanced Design  | Yes  |
|        |                        |                |  |  |
|        |                        |                | Tandem Design Back to Back Design  |  |
|        |                        |                | Dack to Back Design  | <del>                                     </del> |
|        |                        | Cartridge      | Internally Mounted Design  | ·  |
| eneral |                        | &              | Externally Mounted design  | Yes  |
| esign  |                        | Componen       | Large Clearance Design   |  |
|        |                        | t              | Tight Clearance Designs  | Yes  |
| 200    |                        |                |  |  |
|        |                        |                | Double seal with pumping ring design   | Yes  |
|        |                        |                | Double seal without pumping ring design  | -  |
|        |                        |                | High Balance Ratio   |  |
|        |                        |                | Low Balance Ratio  | Yes  |
|        |                        |                |  |  |
|        |                        |                | Spring Loaded Design Metal Bellows Design  | <u> </u>   |
| -      | l-                     |                | Metal Delivas Design   |  |
|        |                        |                | Light Spring Load Per Square Inch  |  |
|        |                        |                | High Spring Load Per Square Inch   |  |
|        |                        |                | Wide Face Width  |  |
|        |                        |                | Narrow Face Width  |  |
|        |                        |                |  |  |
|        |                        | Cartridge      | Single Seal with Large Dual Tangential Flush Holes Single Seal with Small Straight Drill Holes Or No Flush Holes   | Yes  |
|        | Design                 | &              | Single Seal with Small Straight Drill Holes Of No Plush Holes  | 103  |
|        | 240.6                  | Componen       | Double seal with two flush holes on same surface   |  |
|        |                        | t              | Double seal with two flush holes 180 degrees apart   |  |
|        | /12                    |                | 21/68 1/4.11   | Yes  |
|        | of                     |                | 316SS Metallurgy Alloy 20 Metallurgy   | 11.5   |
|        | constructio            |                | Hastelloy C Metallurgy   |  |
|        | n                      | t              | Titanium Metallurgy  |  |
|        |                        | Cartridge      | Practice of using OEM certified glands in repair/rebuild   |  |
|        |                        | Cartriage<br>& | Practice of using OEM certified glands in repair/rebuild   |  |
|        |                        |                |  |  |
|        |                        | 1              | Practice of replacing glands on cartridge seals with pitted surfaces   | <del> </del>                                     |
|        |                        |                | Practice of reusing glands on cartridge seals with pitted surfaces   | 1  |
|        |                        |                | Practice of replacing gland on cartridge seals with damaged (elongated) spring holes   |  |
| lands  |                        |                | Practice of reusing gland on cartridge seals with damaged (elongated) spring holes   |  |
|        |                        | Cartridge      |  | 26:  |
|        |                        |                | Practice of replacing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland  Practice of reusing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland | 1  |
|        | Dansin &               |                | ,  |  |
|        | Repair &<br>Rebuilding |                | Practice of replacing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland  |  |
|        | Procedures             |                | Practice of reusing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland  | +  |
|        | 1202                   | <del></del>    | Practice of replacing glands on component seals with pitted surfaces   |  |
|        |                        |                | Practice of reusing glands on component seals with pitted surfaces   |  |
|        | 1200                   |                |  | I  |
|        | 1202                   |                |  | <del></del>                                      |
|        | 1200                   |                | Practice of replacing gland on component seals with damaged (elongated) spring holes   |  |
|        | 1202                   | Componen<br>t  | Practice of reusing gland on component scals with damaged (clongated) spring holes   |  |

| 1                                       | - 1         | l            |  | <del></del> |
|---|-------------|--------------|--|-------------|
|   |             | j            | Practice of replacing countries and seals with missing anti-rotation lugs, pins, tabs, (tangs) in gr   |             |
|   | ĺ           |              | Practice of reusing component scals with missing anti-rotation lugs, pins, tabs, (tangs) in gland  | <del></del> |
| <u> </u>                                |             | L            | received the second sec |             |
| -                                       | Materials   | Cartridge    | 316SS Metallurgy   |             |
|   | of          | &            | Alloy 20 Metallurgy  | Yes         |
|   | constructio |              | Hastelloy C Metallurgy   |             |
|   | i i         | Componen     |  |             |
|   | n           | <u> </u>     | Titanium Metallurgy  |             |
|   | ·           | <del>,</del> |  |             |
|   |             |              | Practice of using OEM certified sleeves in repair/rebuild  |             |
|   |             | ]            | Practice of not using OEM certified sleeves in repair/rebuild  |             |
|   | ĺ           |              |  |             |
|   |             | •            | Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve  |             |
|   | 1           | •            | Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve  |             |
|   |             |              |  |             |
|   |             |              | Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve   |             |
|   |             |              | Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve   |             |
|   |             |              |  |             |
|   | 1           |              | Practice of replacing sleeves on cartridge seals with damaged (clongated) spring holes   |             |
|   | 1           |              | Practice of reusing sleeves on cartridge seals with damaged (clongated) spring holes   |             |
|   |             |              | See and the see an |             |
|   |             |              | Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to  |             |
|   |             | Cartridge    |  | 1           |
|   | ł           |              |  |             |
|   | - 1         |              | Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve   | 1           |
|   | · [         |              | reactive of reasing cardiage scars with work drive lugs, plus, tabs, (tallgs) on rotally unit set sciewed to steeve  |             |
|   | İ           |              | Denoting of contains and sides and with reigning dairy laboration take (1992) and the side of contains and the sides of co |             |
|   |             |              | Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to   |             |
| Siceves                                 |             |              | sleeve   |             |
|   |             |              | Practice of reusing cartridge scals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to   |             |
| Barrel                                  | 1           |              | sleeve   |             |
|   | Repair &    |              |  |             |
| Ţ                                       | Rebuilding  |              | Practice of replacing sleeves on cartridge seals with pitted surfaces  |             |
|   | Procedures  |              | Practice of reusing sleeves on cartridge seals with pitted surfaces  |             |
| <b>=</b>                                | İ           |              |  |             |
| <u> </u>                                |             |              | Practice of replacing damaged (fretted) sleeves on cartridge seals   |             |
| lii                                     |             |              | Practice of reusing damaged (fretted) sleeves on cartridge seals   |             |
| .A                                      |             |              |  |             |
|   |             |              | Practice of using OEM certified barrels in repair/rebuild  |             |
| 7.                                      |             |              | Practice of not using OEM certified barrels in repair/rebuild  |             |
|   |             | Componen     |  |             |
| _                                       | •           |              | Practice of replacing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit   |             |
| ======================================= |             |              | Practice of reusing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit   |             |
|   |             |              |  |             |
| li                                      |             |              | Practice of replacing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit  |             |
| T1                                      |             |              | Practice of reusing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit  |             |
| <b>년</b><br>= :                         |             |              |  |             |
|   |             | t            | Practice of replacing rotary units on component seals with damaged (elongated) spring holes  |             |
| _                                       |             |              | Practice of reusing rotary units on component seals with damaged (clongated) spring holes  |             |
| <br>                                    |             |              | ractice of reasing Totally units on component sears with damaged (clongated) spring notes  |             |
|   |             |              | Practice of replacing barrels on component seals with pitted surfaces  |             |
|   | •           |              |  |             |
|   | ŀ           |              | Practice of reusing barrels on component seals with pitted surfaces  |             |
|   | 1           |              | Destruction of the state of the |             |
|   | 1           |              | Practice of replacing damaged (fretted) rotary sleeves or barrels on component seals.  |             |
|   | _1          |              | Practice of reusing damaged (fretted) rotary sleeves or barrels on component seals.  |             |
|   | 1, 2        |              |  |             |
|   | Materials   |              | 316SS Metallurgy   |             |
|   | of          | &            | Alloy 20 Metallurgy  |             |
|   | constructio | Componen     | Hastelloy C Metallurgy   |             |
|   | n           | t            | Titanium Metallurgy  |             |
|   |             |              |  |             |
|   |             | Cartridge    | Practice of using OEM certified face holders in repair/rebuild   |             |
|   | 1           | &            |  |             |
|   |             | Componen     | Practice of not using OEM certified face holders in repair/rebuild   |             |
|   | ]           | -            |  |             |
| Face                                    |             |              | Practice of replacing face holders on cartridge seals with pitted surfaces   |             |
| Holder                                  | s           |              | Practice of reusing face holders on cartridge scals with pitted surfaces   | ·           |
|   | Repair &    | Cartridge    | P- 2010 1111 Prints on Thomas  |             |
|   | Rebuilding  |              | Practice of replacing face holders on cartridge seals with worn drive/anti-rotation slots  |             |
|   | Procedures  |              | Practice of reusing face holders on cartridge seals with worn drive/anti-rotation slots  |             |
|   |             |              | . Control of Committee to to to to the control of t |             |
|   |             |              | Practice of renlacing face holders on component seals with sitted aufface.   |             |
|   |             |              | Practice of replacing face holders on component seals with pitted surfaces   |             |
|   |             | Componen     | Practice of reusing face holders on component seals with pitted surfaces   |             |
|   |             | t            | D  |             |
|   | 1           | 1 [          | Practice of replacing face holders on component seals with worn drive/anti-rotation slots  |             |

FC.

|       |                  |  | Practice of reusing face son component seals with worn drive/anti-rotation slots   |                                       |
|-------|------------------|--|--|---------------------------------------|
|       | Materials        | Cartridge                                    | 316SS Metallurgy   |                                       |
|       | of               | &  | Alloy 20 Metallurgy  |                                       |
|       | constructio      | Componen                                     | Hastelloy C Metallurgy   |                                       |
|       | n                | <u>     i                               </u> | Titanium Metallurgy  |                                       |
|       |                  | Control                                      |  |                                       |
|       |                  | Cartridge<br>&                               | Practice of using OEM certified lock collars in repair/rebuild   |                                       |
|       |                  | _ 1  | Practice of not using OEM certified lock collars in repair/rebuild   |                                       |
|       |                  | τ  |  |                                       |
|       |                  |  | Practice of replacing cartridge seals with damaged/oversized set screw holes on lock collars.  |                                       |
| ock . |                  |  | Practice of reusing cartridge seals with damaged/oversized set screw holes on lock collars.  |                                       |
| llars |                  |  |  |                                       |
|       | Repair &         | •  | Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on lock collar   | <del></del>                           |
|       | Rebuilding       |  | Practice of reusing cartridge seals with wom drive lugs, pins, tabs, (tangs) on lock collar  | <del></del>                           |
|       | Procedures       | Cartridge                                    | B. C. I. Santida and mid-mid-mid-mid-mid-mid-mid-mid-mid-mid-  |                                       |
|       |                  |  | Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on lock collar  Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) on lock collar   | <del></del>                           |
|       |                  |  | Practice of reusing cartridge sears with missing drive rugs, plus, tabs, (tangs) on lock conar   |                                       |
|       |                  |  | Practice of replacing lock collars on cartridge seals with pitted surfaces   | <del></del>                           |
|       |                  |  | Practice of replacing lock collars on cartridge seals with pitted surfaces   | <del></del>                           |
|       |                  |  | Flactice of reasing fock contains on carefuge seals with pixels surfaces   |                                       |
|       |                  | Componen                                     | Practice of replacing component seals with damaged/oversized set screw holes.  |                                       |
|       |                  |  | Practice of reusing component seals with damaged/oversized set screw holes.  |                                       |
|       | L                |  |  |                                       |
|       |                  |  | Practice of using OEM certified faces in repair/rebuild  |                                       |
|       |                  |  | Practice of not using OEM certified faces in repair/rebuild  |                                       |
|       |                  |  |  |                                       |
|       |                  |  | One Piece Carbon Soft Face Material Under Compression  |                                       |
|       | 1                |  | One Piece Carbon Soft Face Material Under Tension  |                                       |
|       | 1                |  | Two Piece Carbon Soft Face Material Under Compression  |                                       |
|       |                  |  | Two Piece Carbon Soft Face Material Under Tension  |                                       |
|       |                  |  |  |                                       |
|       |                  |  | Practice of replacing soft seal faces on cartridge and component seals.  |                                       |
|       |                  |  | Practice of reusing relapped soft seal faces on cartridge and component seals.   |                                       |
|       |                  |  | O. Di . C U. I F Material III de Companier   | · · · · · · · · · · · · · · · · · · · |
|       |                  |  | One Piece Ceramic Hard Face Material Under Compression One Piece Ceramic Hard Face Material Under Tension  |                                       |
|       |                  |  | Two Piece Ceramic Hard Face Material Under Compression   | <del></del>                           |
| •     |                  |  | Two Piece Ceramic Hard Face Material Under Tension   |                                       |
|       | 1                |  | Two rivers control and rivers co |                                       |
|       | ĺ                |  | One Piece Plated TC Hard Face Material Under Compression   |                                       |
|       |                  |  | One Piece Plated TC Hard Face Material Under Tension   |                                       |
|       |                  |  | Two Piece Plated TC Hard Face Material Under Compression   |                                       |
|       | 1                |  | Two Piece Plated TC Hard Face Material Under Tension   |                                       |
|       | Ì                |  |  |                                       |
|       | ' <sub>I/B</sub> | Cartridge                                    | One Piece Nick. Bonded TC Hard Face Material Under Compression   |                                       |
|       | Stationary       | &  | One Piece Nick. Bonded TC Hard Face Material Under Tension   |                                       |
|       | Face             | 1 •  | Two Piece Nick. Bonded TC Hard Face Material Under Compression   | -                                     |
|       | Materials        | t  | Two Piece Nick. Bonded TC Hard Face Material Under Tension   |                                       |
|       | of               |  |  |                                       |
|       | Constructi       |  | One Piece Rxn Bond SC Hard Face Material Under Compression   |                                       |
|       | on               |  | One Piece Rxn Bond SC Hard Face Material Under Tension   |                                       |
|       | · ·              |  | Two Piece Rxn Bond SC Hard Face Material Under Compression   |                                       |
|       |                  |  | Two Piece Rxn Bond SC Hard Face Material Under Tension   |                                       |
|       | 1                |  | On Pinn Alaka SC Hard Vine Mittaid Under Commission  |                                       |
|       |                  |  | One Piece Alpha SC Hard Face Material Under Compression  | <del> </del>                          |
|       |                  |  | One Piece Alpha SC Hard Face Material Under Tension  Two Piece Alpha SC Hard Face Material Under Compression   |                                       |
|       | 1                |  | Two Piece Alpha SC Hard Face Material Under Compression Two Piece Alpha SC Hard Face Material Under Tension  |                                       |
|       | 1                |  | TWO FIGGE CUPITS DC TISTO FACE INTENTIAL CHACK TEISTON   |                                       |
|       |                  | }  | One Piece Chrome Oxide Hard Face Material Under Compression  |                                       |
|       | 1                | İ  | One Piece Chrome Oxide Hard Face Material Under Tension  |                                       |
|       | I                |  | Two Piece Chrome Oxide Hard Face Material Under Compression  |                                       |
|       | 1                | l·   | Two Piece Chrome Oxide Hard Face Material Under Tension  |                                       |
|       |                  |  |  |                                       |
|       |                  | 1  | Practice of replacing hard seal faces on cartridge and component seals.  |                                       |
|       |                  | 1  | Practice of reusing relapped hard seal faces on cartridge and component seals.   |                                       |
|       |                  |  |  |                                       |
|       | 1                |  | Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.  |                                       |
|       |                  |  | Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.  |                                       |
|       |                  |  |  | 1                                     |

Faces

|            |             | Practice of reusing rotates with fretting corrosion (common on rotary faces that use tell on ID of faces (Most of the on stainless steel chrome oxide plated faces)   |             |     |
|------------|-------------|---|-------------|-----|
|            | 1           |   |             |     |
|            |             | Practice of using OEM certified faces in repair/rebuild  Practice of not using OEM certified faces in repair/rebuild  |             |     |
|            |             | Tractice of not using Object continue races in repair/count   |             |     |
|            | 1           | One Piece Carbon Soft Face Material Under Compression   |             |     |
|            |             | One Piece Carbon Soft Face Material Under Tension   |             |     |
|            | ٠,          | Two Piece Carbon Soft Face Material Under Compression   |             |     |
|            |             | Two Piece Carbon Soft Face Material Under Tension   |             |     |
|            |             | Practice of replacing soft seal faces on cartridge and component seals.   | · · ·       |     |
|            | 1           | Practice of reusing relapped soft seal faces on cartridge and component seals.  |             |     |
|            |             |   |             |     |
|            | Ĺ           | One Piece Ceramic Hard Face Material Under Compression  |             |     |
|            |             | One Piece Ceramic Hard Face Material Under Tension Two Piece Ceramic Hard Face Material Under Compression   |             |     |
|            |             | Two Piece Ceramic Hard Face Material Under Tension  |             |     |
|            |             | - NO STORY OF THE PROPERTY OF |             |     |
|            |             | One Piece Plated TC Hard Face Material Under Compression  |             |     |
|            |             | One Piece Plated TC Hard Face Material Under Tension  |             |     |
|            |             | Two Piece Plated TC Hard Face Material Under Compression  |             |     |
|            |             | Two Piece Plated TC Hard Face Material Under Tension  |             |     |
|            | Cartridge   | One Piece Nick. Bonded TC Hard Face Material Under Compression  |             |     |
| I/B Rotary |             | One Piece Nick. Bonded TC Hard Face Material Under Tension  | <del></del> |     |
| Face       |             | Two Piece Nick. Bonded TC Hard Face Material Under Compression  |             |     |
| Materials  | t           | Two Piece Nick. Bonded TC Hard Face Material Under Tension  |             |     |
| of .       |             |   |             |     |
| Constructi |             | One Piece Rxn Bond SC Hard Face Material Under Compression One Piece Rxn Bond SC Hard Face Material Under Tension   |             |     |
| on         |             | Two Piece Rxn Bond SC Hard Face Material Under Compression  |             |     |
|            |             | Two Piece Rxn Bond SC Hard Face Material Under Tension  |             | ۴   |
|            |             | 71000   |             | 1   |
|            |             | One Piece Alpha SC Hard Face Material Under Compression   |             | ij. |
|            |             | One Piece Alpha SC Hard Face Material Under Tension   | Yes 🖽 🗀 🖽   | • ( |
|            |             | Two Piece Alpha SC Hard Face Material Under Compression Two Piece Alpha SC Hard Face Material Under Tension   |             |     |
|            |             | Two Piece Alpha SC Hard Face Material Under Tension   |             |     |
|            |             | One Piece Chrome Oxide Hard Face Material Under Compression   |             |     |
|            |             | One Piece Chrome Oxide Hard Face Material Under Tension   |             |     |
|            |             | Two Piece Chrome Oxide Hard Face Material Under Compression   |             |     |
|            |             | Two Piece Chrome Oxide Hard Face Material Under Tension   |             |     |
| 1          |             | Practice of replacing hard seal faces on cartridge and component seals.   |             |     |
|            |             | Practice of reusing relapped hard scal faces on cartridge and component scals.  |             |     |
|            |             |   |             |     |
|            |             | Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.   |             |     |
|            |             | Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.   |             |     |
|            |             | Practice of replacing rotary units with fretting corrosion visible on ID of faces   |             |     |
|            | Componen    | Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible   |             |     |
|            | t           | on ID of faces (Most common on stainless steel chrome oxide plated faces)   |             |     |
|            |             | · · · · · · · · · · · · · · · · · · ·   |             |     |
|            |             | Soft Face Combination Carbon/Carbon   |             |     |
|            | Cartridge   | Soft Face Combination Carbon/Ceramic Soft Face Combination Carbon/Plated TC   |             |     |
|            | &           | Soft Face Combination Carbon/Nick, Bonded TC  |             |     |
| I/B Faces  | Componen    | Soft Face Combination Carbon/Rxn Bond SC  |             |     |
| In         | '           | Soft Face Combination Carbon/Alpha SC   |             |     |
| Combinati  |             | Soft Face Combination Carbon/Chrome Oxide   |             |     |
| on         | Cardaldaa   | II 1 P . O . L' . C . 0000  |             |     |
|            | Cartriage & | Hard Face Combination SC/SC Hard Face Combination SC/TC   |             |     |
|            |             | Hard Face Combination TC/TC   |             |     |
|            | t           | Hard Face Combination Cer/Cer   |             |     |
|            |             |   |             |     |
|            |             | Practice of using OEM certified faces in repair/rebuild   |             |     |
|            |             | Practice of not using OEM certified faces in repair/rebuild   |             |     |
|            |             | One Piece Carbon Soft Face Material Under Compression   | <del></del> |     |
|            | 1           |   |             |     |
| '          |             | One Piece Carbon Soft Face Material Under Tension   |             |     |
|            |             | One Piece Carbon Soft Face Material Under Tension Two Piece Carbon Soft Face Material Under Compression   |             |     |

Practice of replacing so aces on cartridge and component seals. Practice of reusing relapped soft seal faces on cartridge and component seals. One Piece Ceramic Hard Face Material Under Compression One Piece Ceramic Hard Face Material Under Tension Two Piece Ceramic Hard Face Material Under Compression Two Piece Ceramic Hard Face Material Under Tension One Piece Plated TC Hard Face Material Under Compression One Piece Plated TC Hard Face Material Under Tension Two Piece Plated TC Hard Face Material Under Compression Iwo Piece Plated TC Hard Face Material Under Tension Cartridge One Piece Nick. Bonded TC Hard Face Material Under Compression O/B One Piece Nick. Bonded TC Hard Face Material Under Tension Stationary Componer Two Piece Nick. Bonded TC Hard Face Material Under Compression Face Two Piece Nick. Bonded TC Hard Face Material Under Tension Materials of One Piece Rxn Bond SC Hard Face Material Under Compression Constructi One Piece Rxn Bond SC Hard Face Material Under Tension on Two Piece Rxn Bond SC Hard Face Material Under Compression Two Piece Rxn Bond SC Hard Face Material Under Tension One Piece Alpha SC Hard Face Material Under Compression One Piece Alpha SC Hard Face Material Under Tension Two Piece Alpha SC Hard Face Material Under Compression Two Piece Alpha SC Hard Face Material Under Tension One Piece Chrome Oxide Hard Face Material Under Compression One Piece Chrome Oxide Hard Face Material Under Tension Two Piece Chrome Oxide Hard Face Material Under Compression Two Piece Chrome Oxide Hard Face Material Under Tension Practice of replacing hard seal faces on cartridge and component seals. Practice of reusing relapped hard seal faces on cartridge and component seals. Practice of replacing seal faces with corrosion/pitting on cartridge and component seals Practice of reusing seal faces with corrosion/pitting on cartridge and component seals. Practice of replacing rotary units with fretting corrosion visible on ID of faces Componen Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces) Practice of using OEM certified faces in repair/rebuild Practice of not using OEM certified faces in repair/rebuild One Piece Carbon Soft Face Material Under Compression One Piece Carbon Soft Face Material Under Tension Two Piece Carbon Soft Face Material Under Compression Two Piece Carbon Soft Face Material Under Tension Practice of replacing soft seal faces on cartridge and component seals. Practice of reusing relapped soft seal faces on cartridge and component seals. One Piece Ceramic Hard Face Material Under Compression One Piece Ceramic Hard Face Material Under Tension Two Piece Ceramic Hard Face Material Under Compression Two Piece Ceramic Hard Face Material Under Tension One Piece Plated TC Hard Face Material Under Compression One Piece Plated TC Hard Face Material Under Tension Two Piece Plated TC Hard Face Material Under Compression Two Piece Plated TC Hard Face Material Under Tension One Piece Nick. Bonded TC Hard Face Material Under Compression O/B One Piece Nick. Bonded TC Hard Face Material Under Tension & Rotary Two Piece Nick. Bonded TC Hard Face Material Under Compression Componen Face Two Piece Nick. Bonded TC Hard Face Material Under Tension Materials of One Piece Rxn Bond SC Hard Face Material Under Compression Constructi One Piece Rxn Bond SC Hard Face Material Under Tension on Two Piece Rxn Bond SC Hard Face Material Under Compression Two Piece Rxn Bond SC Hard Face Material Under Tension

|             |  | į.   |  |             |
|-------------|--|--|--|-------------|
| ı           | 1  | I  | One Piece Alpha SC H   |             |
| 100         | 1  | 1  | One Piece Alpha SC Hard-race Material Under Tension  |             |
|             | 1  |  | Two Piece Alpha SC Hard-Face Material Under Compression  | <del></del> |
| į           |  |  | Two Piece Alpha SC Hard Face Material Under Tension  | <del></del> |
| 1           |  |  | TWO FIELD AND THE TANK THE CHIEF TEISTON   | <del></del> |
| i           | •  | 1  | One Piece Chrome Oxide Hard Face Material Under Compression  | <del></del> |
| 1           | 1  |  |  |             |
|             |  |  | One Piece Chrome Oxide Hard Face Material Under Tension  |             |
|             |  |  | Two Piece Chrome Oxide Hard Face Material Under Compression  |             |
|             | •  |  | Two Piece Chrome Oxide Hard Face Material Under Tension  |             |
|             |  |  |  |             |
| 1           |  |  | Practice of replacing hard seal faces on cartridge and component seals.  | •           |
| 1           | 1  |  | Practice of reusing relapped hard seal faces on cartridge and component seals.   |             |
|             | 1  |  |  |             |
|             |  |  | Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.  | _           |
|             | 1  | 1  | Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.  |             |
|             |  |  | reflect of reasing sear faces with corrosion/pitting on cartiling and component sears.   |             |
|             | 1  | <u> </u>   | In a control of the c | <u> </u>    |
|             |  | Componen   | Practice of replacing rotary units with fretting corrosion visible on ID of faces  |             |
| 1           | 1  | i  | Practice of reusing rotary units with fretting corrosion (common on rotary faces that use tellon v rings) visible  |             |
|             |  |  | on ID of faces (Most common on stainless steel chrome oxide plated faces)  |             |
|             |  |  |  |             |
| 1           |  |  | Soft Face Combination Carbon/Carbon  |             |
|             |  | 1  | Soft Face Combination Carbon/Ceramic   | -           |
| 1           | 1  |  | Soft Face Combination Carbon/Plated TC   |             |
| 1           | 1  |  | Soft Face Combination Carbon/Nick. Bonded TC   |             |
| 1           | O/B Faces  | Cambridge  | Soft Face Combination Carbon/Rxn Bond SC   |             |
| 1           |  | 1 -  |  |             |
| 1           | In .   | &  | Soft Face Combination Carbon/Alpha SC  |             |
| 1           | Combinati  | -  | Soft Face Combination Carbon/Chrome Oxide  |             |
| 1           | on   | t  |  |             |
| 1           |  | 1  | Hard Face Combination SC/SC  |             |
| ŧ.          |  |  | Hard Face Combination SCFC   |             |
| ľ           |  | 1  | Hard Face Combination TC/TC  |             |
| Į.          |  | 1  | Hard Face Combination Cer/Cer  |             |
|             |  | L  |  |             |
|             |  | Cartridge  | O-ring Elastomer Type  |             |
| Ĺ           | •  | &  | Teflon V-Ring Elastomer Type   | Yes         |
| į.          | I/B Design   |  |  | 163         |
| 1           |  |  | Teflon Wedge-Ring Elastomer Type   |             |
| 1           |  | t  | Teflon U-Cup Elastomer Type  |             |
| 1           |  |  |  |             |
|             |  |  | Viton Elastomer Material   |             |
|             | I/B  | Cartridge  | EPR Elastomer Material   |             |
|             | Materials  | &  | Teflon Elastomer Material  |             |
|             | of   | i i  | Aflas Elastomer Material   |             |
|             | Constructi   | Componen   | Kalrez Elastomer Material  |             |
|             | on   | t  | Chemraz Elastomer Material   |             |
|             |  |  | Graphoil Elastomer Material  |             |
|             | <b></b>  |  |  |             |
|             |  | Cartridge  | O-ring Elastomer Type  |             |
| 1           | O/B  | &  | Teflon V-Ring Elastomer Type   |             |
| F14         |  |  |  |             |
| Elastomer   | - I D :  | 1  |  |             |
|             | B Design   | Componen   | Teflon Wedge-Ring Elastomer Type   |             |
| 2,000000    | s Design   | 1  |  |             |
| Significant | s Design   | Componen   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type   |             |
|             | s Design   | Componen   | Teflon Wedge-Ring Elastomer Type   |             |
|             | Design O/B   | Componen<br>t  | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type   |             |
|             | O/B  | Componen<br>t  | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material   |             |
|             | O/B<br>Materials   | Componen<br>t<br>Cartridge   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aftas Elastomer Material   |             |
|             | O/B<br>Materials   | Componen<br>t  | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material  |             |
|             | O/B<br>Materials<br>of<br>Constructi                           | Componen<br>t<br>Cartridge   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material  |             |
|             | O/B<br>Materials   | Cartridge & Componen   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material   |             |
|             | O/B<br>Materials<br>of<br>Constructi                           | Cartridge & Componen   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material  |             |
|             | O/B<br>Materials<br>of<br>Constructi                           | Cartridge & Componen   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material   |             |
|             | O/B<br>Materials<br>of<br>Constructi                           | Cartridge<br>&<br>Componen<br>t  | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material   |             |
|             | O/B Materials of Constructi on Repair &                        | Cartridge & Componen t   | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material   |             |
|             | O/B<br>Materials<br>of<br>Constructi                           | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild   |             |
|             | O/B Materials of Constructi on Repair &                        | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild   |             |
|             | O/B Materials of Constructi on Repair & Rebuilding             | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of replacing elastomers   |             |
|             | O/B Materials of Constructi on Repair & Rebuilding             | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild   |             |
|             | O/B Materials of Constructi on Repair & Rebuilding             | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild  Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  |             |
|             | O/B Materials of Constructi on Repair & Rebuilding             | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers Practice of reusing elastomers  |             |
|             | O/B Materials of Constructi on Repair & Rebuilding             | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers Practice of reusing elastomers  Practice of reusing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil)   |             |
|             | O/B Materials of Constructi on  Repair & Rebuilding Procedures | Cartridge & Componen t  Cartridge & Componen t                         | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil) Spring Type (Multiple Coil)  | Yes         |
|             | O/B Materials of Constructi on Repair & Rebuilding             | Cartridge & Componen t  Cartridge & Componen t  Cartridge & Componen t | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil) Metal Bellows Design  Metal Bellows Design  Metal Bellows Design   | Yes         |
|             | O/B Materials of Constructi on  Repair & Rebuilding Procedures | Cartridge & Componen t  Cartridge & Componen t  Cartridge & Componen t | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil) Spring Type (Multiple Coil) Metal Bellows Design   | Yes         |
|             | O/B Materials of Constructi on  Repair & Rebuilding Procedures | Cartridge & Componen t  Cartridge & Componen t  Cartridge & Componen t | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil) Metal Bellows Design  Metal Bellows Design  Metal Bellows Design   | Yes         |
|             | O/B Materials of Constructi on  Repair & Rebuilding Procedures | Cartridge & Componen t  Cartridge & Componen t  Cartridge & Componen t | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil) Spring Type (Multiple Coil) Metal Bellows Design  Out of Fluid Design  | Yes         |
|             | O/B Materials of Constructi on  Repair & Rebuilding Procedures | Cartridge & Componen t  Cartridge & Componen t  Cartridge & Componen t | Teflon Wedge-Ring Elastomer Type Teflon U-Cup Elastomer Type  Viton Elastomer Material EPR Elastomer Material Teflon Elastomer Material Aflas Elastomer Material Kalrez Elastomer Material Chemraz Elastomer Material Graphoil Elastomer Material  Practice of using OEM certified elastomers in repair/rebuild Practice of not using OEM certified elastomers in repair/rebuild  Practice of replacing elastomers  Practice of reusing elastomers  Spring Type (Wave Spring) Spring Type (Single Coil) Spring Type (Multiple Coil) Metal Bellows Design   |             |

区。

| h          | 1 c        |           |   |                                       |
|------------|------------|-----------|---|---------------------------------------|
| l _        | ıc         | &         | Alloy 20 Metallurgy   | · · · · · · · · · · · · · · · · · · · |
| Face       |            |           | Hastelloy C Metallurgy  |                                       |
| Energizing | n          | t         | Titanium Metallurgy   |                                       |
| Mechanis   |            |           |   |                                       |
| m          |            |           | Practice of using OEM certified springs in repair/rebuild           |                                       |
|            |            |           | Practice of not using OEM certified springs in repair/rebuild       |                                       |
| `          |            |           |   |                                       |
| 1          |            |           | Practice of using OEM certified metal bellows in repair/rebuild     |                                       |
| 1          | Repair &   | Carunage  | Practice of not using OEM certified metal bellows in repair/rebuild |                                       |
|            | Rebuilding | &:        |   |                                       |
|            | Procedures | Componen  | Practice of replacing springs                                       |                                       |
|            |            | ı         | Practice of reusing springs   | •                                     |
|            |            |           |   |                                       |
|            |            |           | Practice of replacing metal bellows                                 |                                       |
|            |            |           | Practice of reusing metal bellows                                   |                                       |
| L          | ــــــا    |           | I receive of reading invest certains                                |                                       |
|            |            |           | Practice of using OEM certified gaskets in repair/rebuild           |                                       |
|            | Repair &   | Cartridge | Practice of using OEM certified gaskets in repair/rebuild           |                                       |
|            | Repair &   | &         | Practice of not using Obivi certified gaskets in repair/rebuild     |                                       |
| Gaskets    | Kebuilding | Componen  | Practice of replacing gaskets                                       |                                       |
|            | Procedures | t         | Practice of replacing gaskets                                       |                                       |
|            |            |           | Practice of reusing gaskets   |                                       |
|            |            |           |   | •                                     |
|            |            |           | Stuffing Box Face Perpendicularity                                  | 003"                                  |
|            |            |           |   |                                       |
| ا ۾ ا      |            |           |   |                                       |
| Seal       |            |           |   |                                       |
| Settings   |            |           |   |                                       |
|            |            |           |   | į                                     |
|            |            |           |   |                                       |

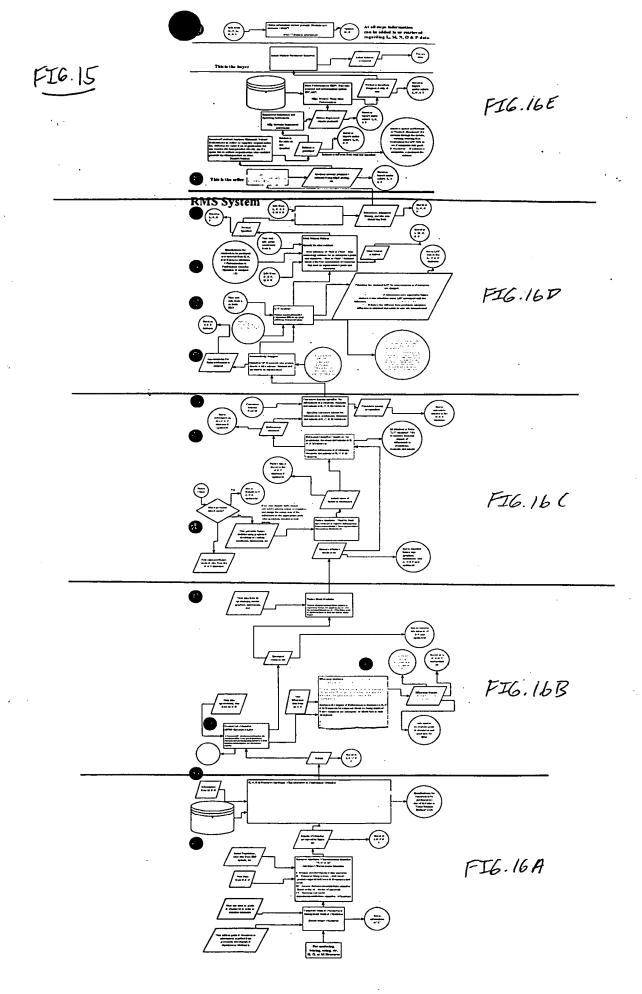
|               |                       |              | Process Fluid          |        |
|---------------|-----------------------|--------------|------------------------|--------|
| •             |                       |              | Acetone; Tem <210 F    | -1302  |
|               |                       |              | System Recommendations |        |
| Product Ten   | perature              | 0            | 150 F                  |        |
| Product Crys  | talizes               |              | Yes                    | 1      |
| Product Poly  | merizes               |              | Yes                    | - 1    |
| Product is T  | nermal Sensitive      |              | No                     | /      |
| Specific Gra  | vity                  | 8            | 1.1                    | (      |
| Vapor Pressu  | re                    |              | 45 PSIA                | > 1304 |
| Viscosity     |                       | . 1          | 15000 SSU              | ( .    |
| Concentration | n                     | <del>_</del> | 75%                    | 1      |
| % Dissolved   | Solids                |              | 1%                     | j      |
| % Undissolv   | ed Non-Fibrous Solids |              | 0.50%                  |        |
| % Undissolv   | ed Fibrous Solids     |              | 2%                     |        |

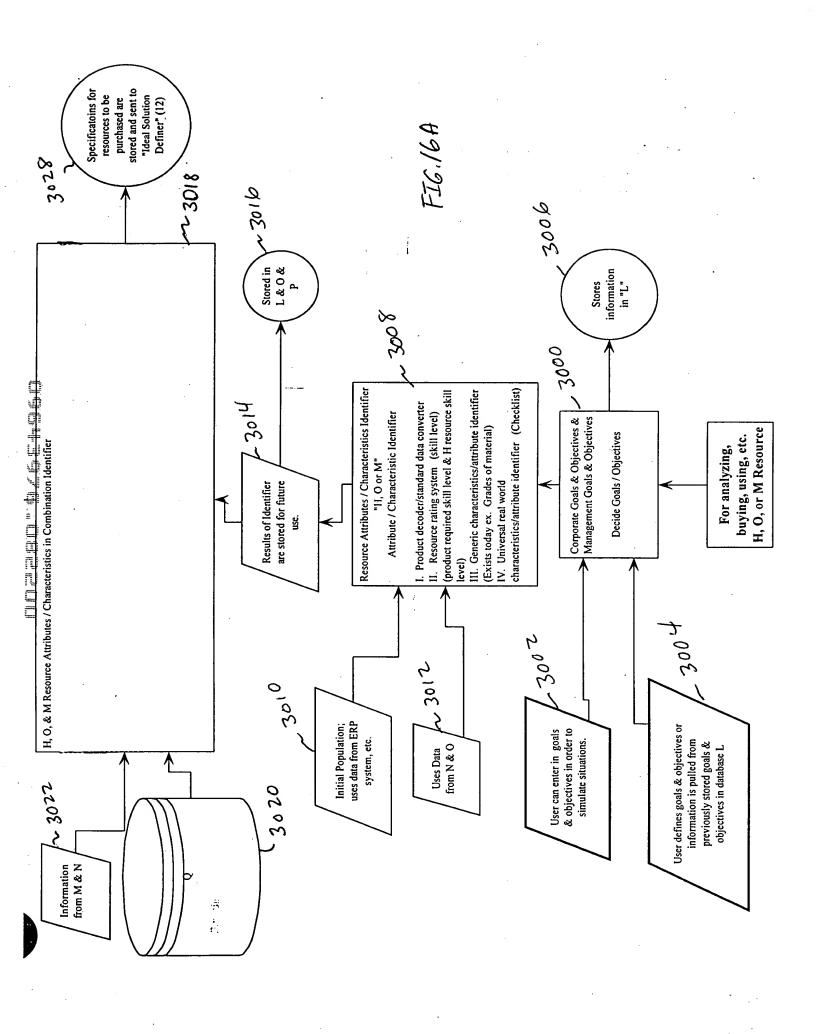
# FIG. 14A

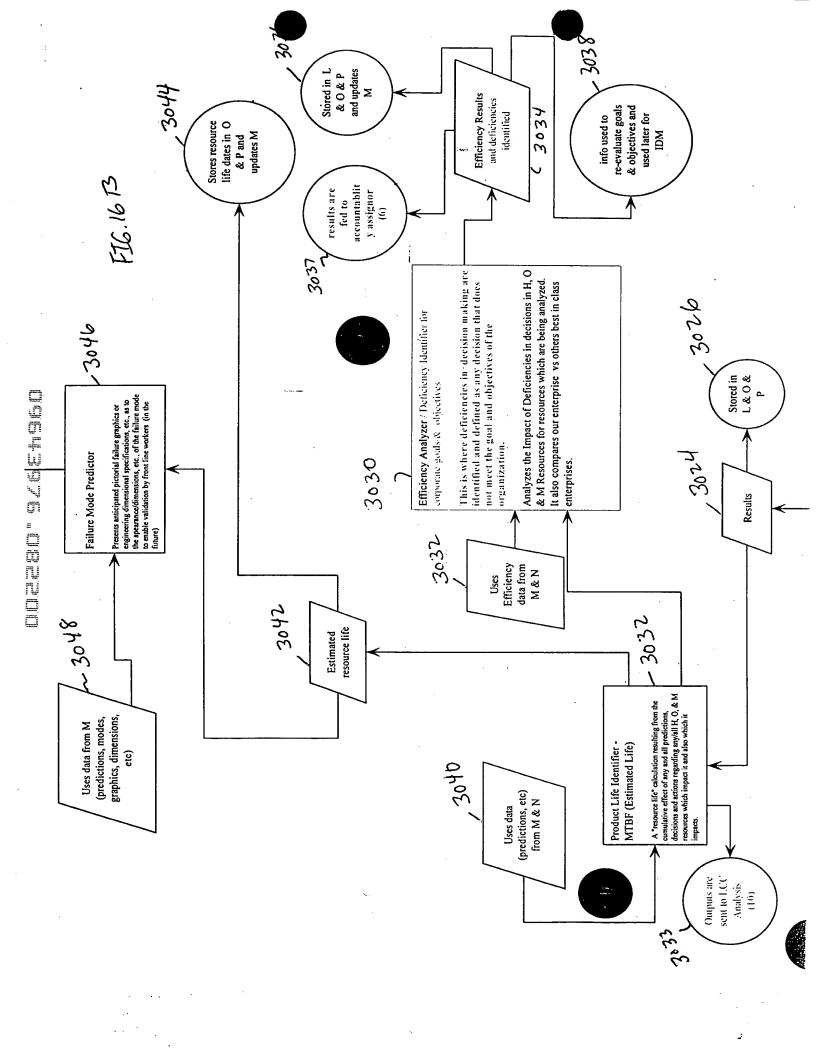
| 1 11/000   | ATTDE Of the Time Date of Edition Co.                                    | <del></del> |
|------------|--|-------------|
| 1400.0     | MTBF (Mean Time Between Failure) for seals in years                      | • -         |
| 1402       | # of days/year plant operates  |             |
| 1404       | # of hours/day plant operates  Vilousette/hours for Asia helmond and     |             |
| 1406 /     | Knowatts/hours for Avg. balanced seal                                    |             |
| 1400       | Additional power required for unbalanced seal                            |             |
| 1408       | Average # of repacks er year   |             |
| 1400       | Average # of adjustments per year per box                                |             |
|            | Average Life of Shaft/Sleeve (in years) Before Replacement Is Required   |             |
|            | Due To Packing & Bearing Failure Damage                                  | •           |
|            | Avg. Seal Water (in gpm) Flush Entering Each Packed Stuffing Box,        |             |
|            | Entering the process stream  |             |
|            | Average Seal Water Flush (in gpm) required for a single mechanical       |             |
|            | seal entering the process stream.  |             |
|            | The Reduction in Seal Water Usage Per Stuffing Box By The Use Of         |             |
|            | Mechanical Seals   |             |
| 1          | Change In Temp. Difference Between System Temp. and Seal Water           |             |
|            | Flush Temp. (Ex. 85 Deg.F. system temp., 65Deg.F. Seal Water             |             |
|            | Temp = 20 Deg.F.)  |             |
|            | Avg. Requirement For A Packed Pump is 2KW Per Hour. Avg. For A           |             |
|            | Balanced Mechanical Scal Is .33KW Per Hour (The Excess Power             | ,           |
|            | Required Per Pump Is 1.67 KW/Hour) Based on 2.000 " seal, adjust up      |             |
|            | or down by average shaft/ sleeve size in plant                           |             |
| i          | Avg. Leakage of Each Stuffing Box in Drops/Min                           |             |
|            | # of Machines With Unscheduled Downtime                                  |             |
|            | 0/ -CD- in D- initia III -1 -1 -1 ID- in A D- to CD                      |             |
|            | % of Equip. Requiring Unscheduled Repairs As a Result of Excess          |             |
|            | Leakage (Ex. Bearing failure due to product leakage contamination)       |             |
|            | Example of short /slave replacement                                      |             |
| Ì          | Frequency of shaft /sleeve replacement                                   |             |
| 1          | % of Component Seals In Which Installation Is Not Correct The First Time |             |
|            | Increased MTBF provided by superior seal design. Average Decrease        |             |
|            | In Seal Life For The Entire Plant Seal Population Due To Existing        |             |
| Overall    | Design Deficiencies  | ·           |
| Plant.     | Increased MTBF provided by ESP software technologies assuring that       | *           |
| Informatio | the correct seals with correct materials of construction and             |             |
| n          | environmental controls with engineering documentation provides           |             |
|            | unsurpassed plant efficiencies.  |             |
|            | Increased MTBF provided plant reliability software which enables         |             |
|            | identification of problems preventing reinstallation of those problems.  |             |
|            | providents.  |             |
|            | Overall Decrease in Seal Life Due To Premature Failure. (Over            |             |
|            | compressed & Under compressed component and erroneous                    |             |
|            | installations)   |             |
|            | ,  |             |
|            | Additional Hours Req'd For Installation vs. Cartridge Design             |             |
|            |  |             |

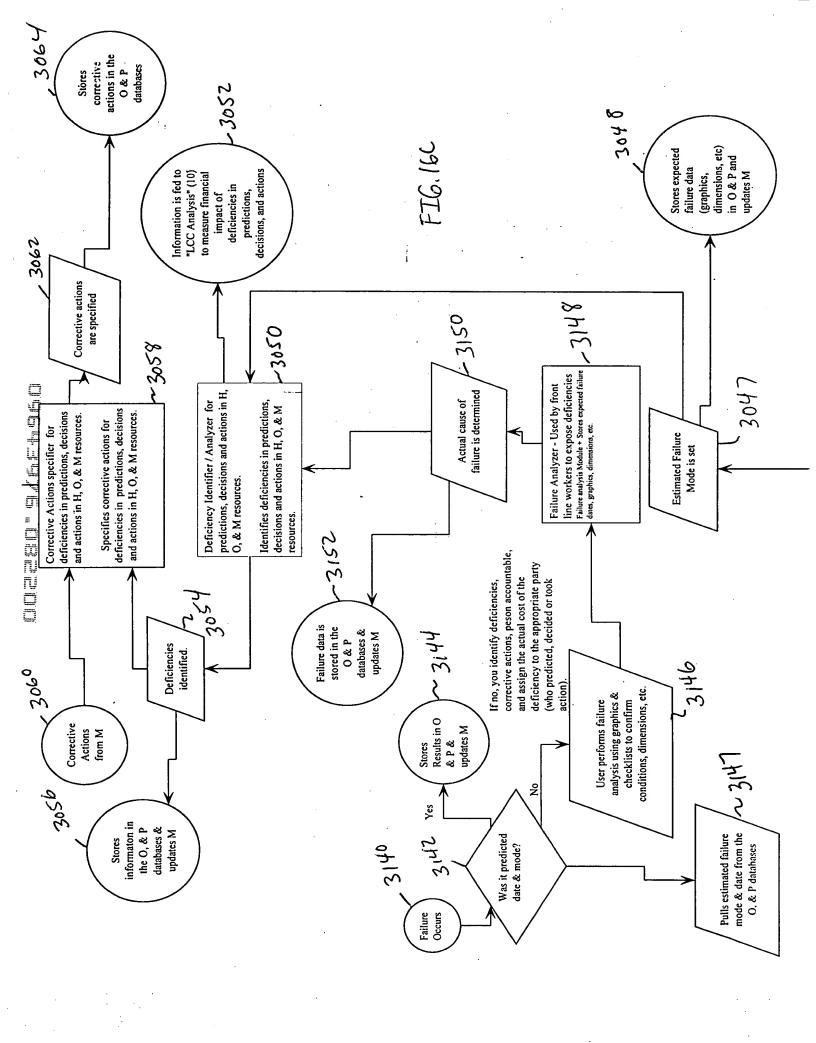
|       | Additional Hours Req'd For Component vs. Cartridge Design                   |     |
|-------|---|-----|
|       | Average Installation Time For A Component Seal                              |     |
|       | Hours Required For Disassembly & Reinstallation of Seal                     |     |
| Lahan | Average # of Manhours Per Repack  |     |
| Labor | Average # of Manhours Per Adjustment  Average # of Manhours Per Replacement | • . |
|       | Average # of Manhours Per Replacement                                       |     |
| n .   | # of Hours Machinery Is Down Per Year Due to Eqpt Failure                   |     |
|       | Attributed to Product Leakage   |     |
|       | # of Housekeeping / Hours Per Year Per Pump (Cleaning Leakage)              |     |
|       |   |     |
|       | # of Hours To Install One Mechanical Seal                                   |     |
|       |   |     |

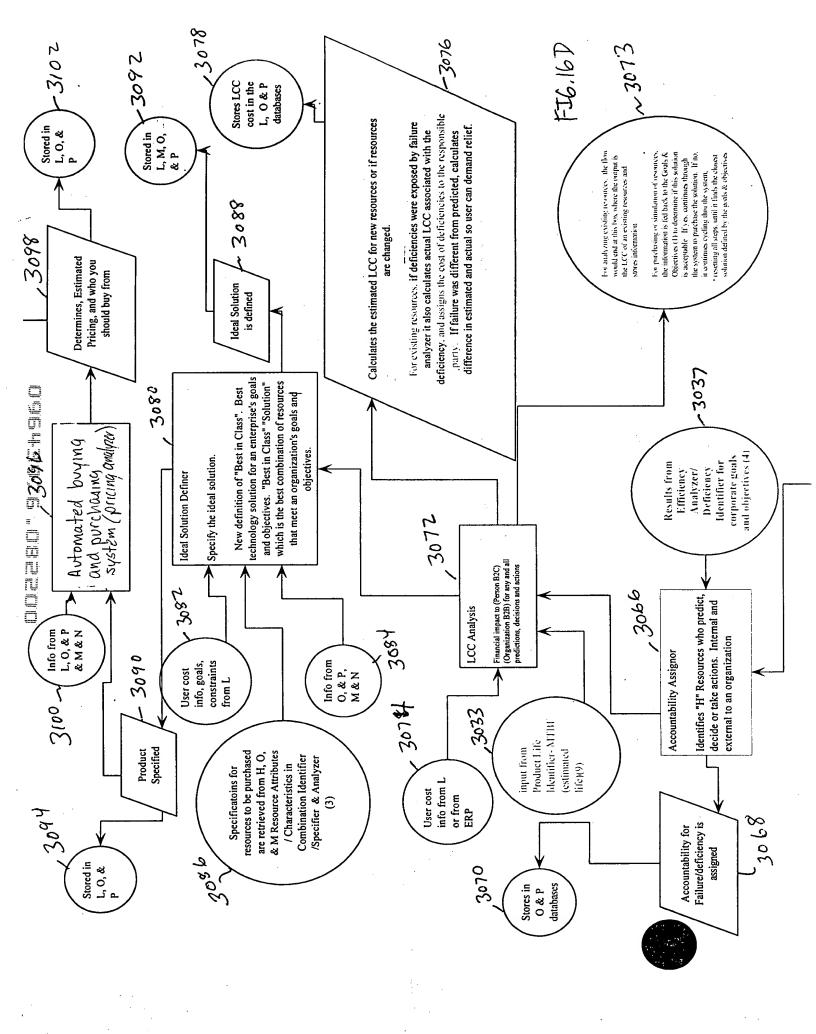
FIG. 14B

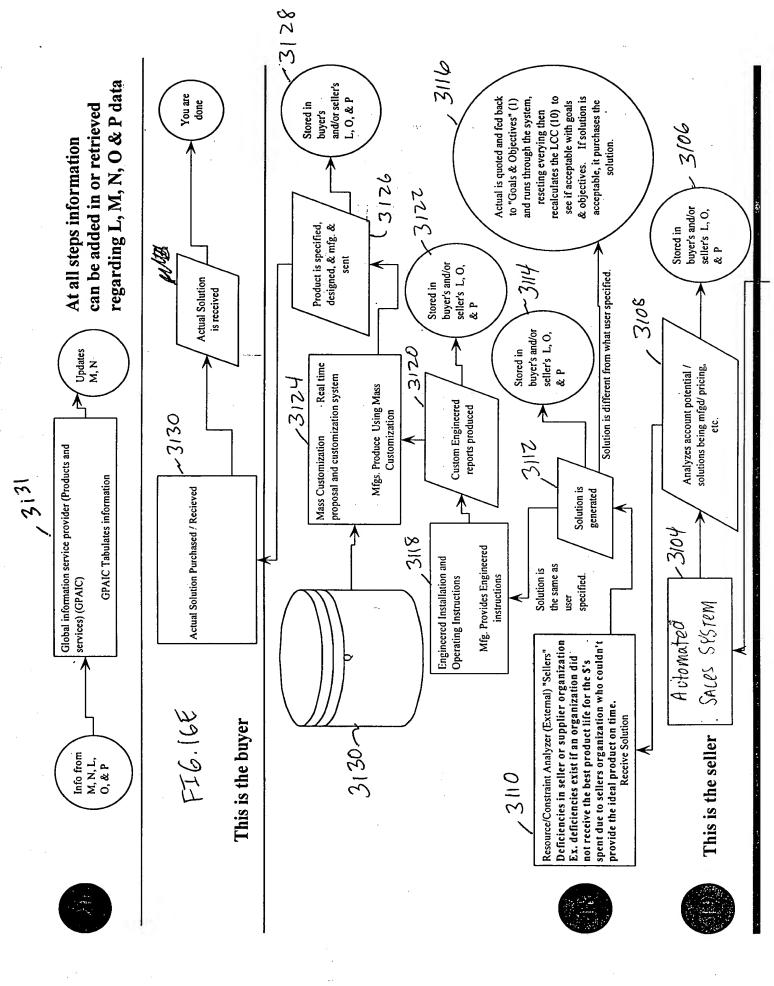












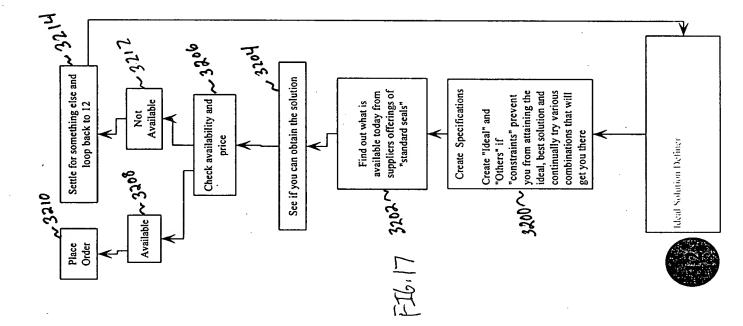


FIG. 18A

| ٠,   | Spring<br>Supplie<br>rs                       | Etc.  |   | 20 years                       |                        | Human  | Scientists / experts assemble in clean room environment, etc. etc.          |  |        |   |  |                                    | ]  |
|------|---|---|---|--------------------------------|------------------------|--|---|--|--------|---|--|------------------------------------|----|
|      | Gasket Suppliers                              | Etc.  |   | 5 years 20                     |                        | Impeller   H                                       | Open impeller er design en  | Estimated life<br>6 years                              |        |   | •                                      |                                    |    |
|      | Gland<br>Suppliers                            | Etc.  |   | 12 years                       | $\left  \cdot \right $ | Shaft Mfgs   | Shaft with L3/D4 of<br>3 made of 316SS<br>with bearing<br>tolerance of ,005 | Estimated life<br>50 years                             |        | all components, etc.  | Seal mfg Life from<br>above            | s years                            |    |
|      | ırs   | Grade C   | Estimated life<br>10 years                                |                                | 1                      |  | , etc.  |  |        | ed expect installs  |  |                                    |    |
|      | O-ring Suppliers                              | Grade B   | Estimated life<br>5 years                                 | (810)                          |                        |  | ith multi coil springs  |  |        | 0 degrees, same trai  | Design with axial shaft play .006-010  | 5 years                            |    |
|      | 1-O   | Grade A   | Estimated life<br>1 year                                  |                                |                        | Seal Mfgs  | Balanced design 75/20 with face width of 100 with multi coil springs, etc.  | Estimated life  5 years  7 8 / ~ 1                     |        | Pump Mfgs   | Design with axial<br>shaft play < .006 | 10 years                           |    |
|      |   | Material PG957  |   |                                |                        | , .  | design 75/20 with   |  |        | P Controlled labora   | Rigidity of Shaft ased on overhang     |                                    |    |
|      | Face Suppliers                                | Material PG792  | Estimated life Estimated life 15 years                    | /                              |                        | -  | Balance   |  |        | denvironment testin   | rame Adapter Fits<br>.005015           | . 5 years                          |    |
|      | Fa  | Material PG523  | Estimated life<br>5 years                                 | \$081                          |                        | Bearing<br>Protection<br>Mfgs                      | Double lip seal design<br>made of Viton with x<br>durometer,                | Estimated life<br>6 years                              | ,      | Pump Mfgs Very limited controlled environment testing. Controlled laboratory conditions of 90 degrees, same trained support installs all components, etc. | 12.                                    | 15 years                           |    |
|      |   |   |   |                                |                        | Mfgs   | Option 2<br>DL Design   | Estimated<br>life 15<br>years                          |        |   | Bearing<br>Housing Fits<br>.010        | 3 years                            | ]- |
| 008  |   |   |   |                                |                        | Bearing Mfgs                                       | Option 1<br>CB Design with<br>lube filter system                            | Estimated life<br>30 years                             |        |   | Bearing Housing<br>Fits .0025          | 10 years                           |    |
| 008) | Mfg. of<br>Component                          | Material  | Fetimated   | Life                           | 7.081                  | Mfg. of<br>Subassemb<br>ly                         | Design  | Estimated<br>Life                                      | 4.081× | Mfg. of<br>Assembly   | Design                                 | Estimated<br>Life for<br>each item |    |
|      | 3 e   | Material<br>Mfgs<br>Perform                           | Laboratory<br>Tests                                       |                                |                        |  | Component Migs Perform Laboratory Tests                                     |  |        |   | Equipment<br>Mfgs                      | Perform<br>Laboratory<br>Tests     | •  |
|      | Each test is<br>performed under<br>controlled | laboratory<br>conditions with pre-<br>selected expert | individuals.<br>Estimated life of<br>each in a controlled | envirorunent on test<br>stands |                        | Each test is performed under controlled laboratory | F PB R  | solution, 70<br>degrees, dust fee<br>room, etc., etc., |        |   | Tests all pieces in combination in     |                                    | •  |
|      |   | -   |   |                                |                        | 2  |   |  |        | 3   |  |                                    |    |

| 2        |
|----------|
| $\infty$ |
| FIG.     |